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HEATING AND VENTILATING

A MONTHLY MAGAZINE FOR ENGINEERS AND CONTRACTORS CONCERNED WITH THE DESIGN AND APPLICATION OF AIR CONDITIONING, REFRIGERATION, PIPING, AIR SANITATION, HEATING AND VENTILATION IN BUILDINGS

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PUBLISHERS OF MACHINERY & MACHINERY'S HANDBOOK
The INDUSTRIAL PRESS

THIS MONTH'S COVER

Lecture scene being televised at the Special Devices Center, Office of Naval Research, Sands Point, Port Washington, Long Island, N. Y., where an air conditioned studio has been set up. Plans are to telecast lectures and demonstrations from a single point to four or more training centers along the Atlantic Seaboard.

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Washington News

LORING F. OVERMAN

AS August merged into September, Washington was in an "anything can happen" cycle, with observers a little unsure as to just what to forecast.

Members of Congress were genuinely tired after a long, hot summer of pressure, delay, exhortations, and maneuvering. Yet Administration leaders—the folks who hold the political purse strings—appeared reluctant to set a day for adjournment, or to promise any specific time when the extra-long session would definitely end.

The situation was almost identical with one which has been offered as an explanation for Communist infiltration into many unions. Not that there's even a hint of such a thing in Congress—but the timing and the strategy follow a familiar pattern. In the case of Leftist unions, it has been explained that a well-organized minority of Commies conspire to stall deliberations and delay decisions by extended debate. One by one, rank-and-file unionists have hurried home (disgusted at the delay and perhaps a little worried as to how to convince the Little Woman that a union meeting could last until the wee small hours). Then, with the rank-and-filers out of the way, the Lefists have taken over, their pooled votes constituting a majority, swinging decisions in accordance with their own wishes.

Members of Congress aren't going to leave the meeting, but by mid-August many were wondering whether it was really worth while to hold steadfastly to their firm convictions. Some were tiring of being made to "stay after school" indefinitely. It is under such conditions that unintended compromises are made—desperation decisions with undesired consequences.

Case in Point — Wage-Hour

Typical of how such things can happen is recent passage by the House of a compromise Fair Labor Standards Act raising minimum wages—if the Senate concurs—to 75¢ per hour, up 35¢ from the present 40¢. From the very opening day of the current Congressional session there were predictions that Congress would never go above a 65¢ figure. Even after the House changed its mind on August 11, many were sure that the Senate would not agree. As of August 25, however, most conceded the Senate would "go along."

One of the danger spots in the situation in late August was the fact that the Senate is behind the House schedule in its consideration of "must" legislation. Thus the House, with its schedule near completion, is in the position of freshmen being required to remain in their seats until the sophomores have finished their lessons. Add this pressure to the natural desire of Senators for dismissal, and the reason for the anything-can-happen cycle is apparent.

Regardless of which side of the fence H&V readers may be on, this would be a mighty good time to drop the Senator or Congressman a letter giving him a pat on the back and telling him his efforts to stand by his guns are appreciated. A fellow can get mighty tired of staying on the job in Washington, passing up his vacation while his constituents have all gone fishing. Sometimes he probably wonders whether he's a "poor fish" himself. A sincere personal letter can do much to let him know which constituent is on which side.

Little Wheels Turn

Although the Big Wheel legislation is somewhat stalled—Reciprocal Trade, Arms Aid, Taft-Hartley, Farm Bills, etc.—a lot of little gears which concern only limited groups are spinning.

For example, on August 22 the House agreed to Senate amendments to a $7.6 billion Independent Offices and Agencies appropriation bill, which includes $17.5 million for rent control.

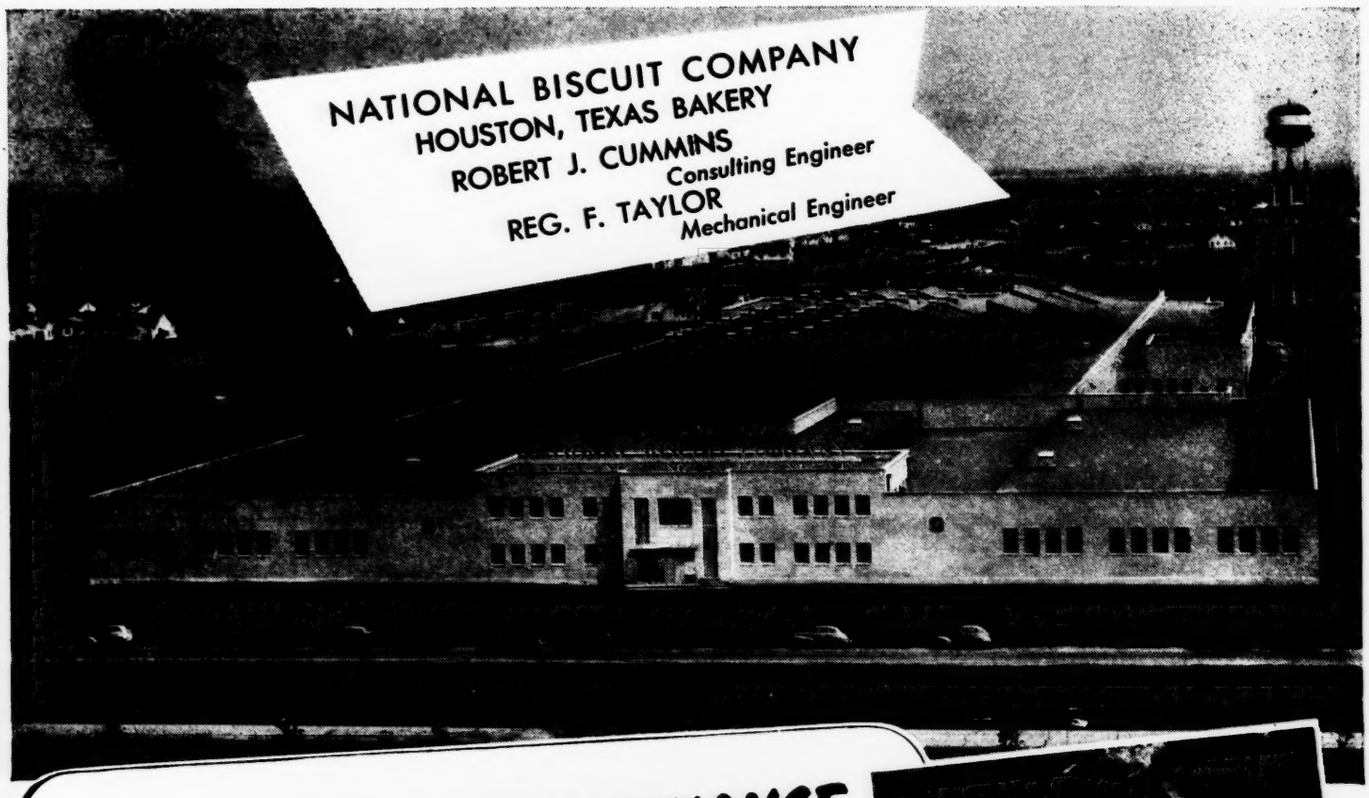
This latter item is of some interest to H&V readers for the reason that Housing Expediter Woods contends that with a reduced budget he will have to discontinue rent control enforcement in about one-third of the areas now controlled. This, in turn, could conceivably change the complexion of construction projects in affected areas. As things now stand, rent control is credited with being responsible for the construction of many large apartment projects of types eligible for new-construction higher rentals reflecting current building costs. Some predict that if rent control were removed, more individual housing might be built. Others contend that just the reverse would be true, and that owners could afford (and would be required) to improve old buildings.

Regardless of interpretation, rent control seems slated for some easing, with a very likely possibility that it will not be extended past its slated termination date, midyear, 1950.

Housing Bill Changes

The middle-income housing bill (H. R. 6070), discussed last month in this column as one seeking to do for middle-income folks some of the things provided for low-income groups by the Housing Act of 1949, underwent a change or two before debate was completed in the House on August 23. Knocked out were proposals to appropriate $300 million in direct loans to veterans, $1 billion in direct loans for cooperatives. Favorable action on other phases of the bill, which continues many functions of the present Housing and Home Financing Agency, is anticipated by the freshmen. Whether the sophomores will find time to add this lesson to their present assignments is something else again.

Another bill of direct interest to H&V readers also made progress. The House Commerce Committee approved H. R. 5903, to increase from $75 million to $150 million the annual federal aid for construction



TO MINIMIZE MAINTENANCE IN THIS 11 ACRE BAKERY— BYERS WROUGHT IRON PIPE

Representing an investment of over $4,000,000, the mammoth new building of National Biscuit Company at Houston is one of the largest baking plants in the United States. To further the designer's aim of maximum utility with minimum maintenance, Byers Wrought Iron pipe was used in a number of vital services, where severe corrosion was anticipated: chilled and condenser water lines in the air conditioning system; underground gas lines; and process lines. One interesting process application is a lard line, installed inside a larger pipe which carries steam to keep the lard liquified. Miles of Byers Wrought Iron pipe are used in this Bakery.

In earlier days when building piping services were confined to plumbing and heating lines, the pipe designer's job was simple, and his own individual experience generally provided an adequate guide in material selection. Today, almost every building has numerous added services, that have brought a new set of corrosive conditions with them. Air Conditioning provides one example . . . and it is significant that an impressive number of installations in the largest buildings have utilized wrought iron. Process lines, of course, require special individual study to determine and interpret the specific corrosive conditions. Here, again, designers have found in wrought iron their answer to a multitude of varied problems.

Wrought iron's superior corrosive resistance comes from its unique composition and structure. Tiny fibers of glass-like silicate slag, threaded through the body of high-purity iron, halt and disperse corrosive attack, and so discourage pitting. The fibers also help to anchor the initial protective scale, which shields the underlying metal.

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CORROSION COSTS YOU MORE THAN WROUGHT IRON

of non-profit hospitals in local communities. The bill would extend the program to July 1, 1955. This one has a very good chance of getting through, for a similar measure (S. 614) has already been passed by the Senate.

Low-Income Program Starts

Appropriate divisions of the Housing and Home Financing Agency went into high gear in August in starting movement on the Housing Act of 1949, which was signed by President Truman on July 15 to provide Federal assistance for slum clearance, public housing, farm housing, and housing research.

By mid-August the printing presses and mimeograph machines were grinding out voluminous explanations of the act, together with invitations for established housing authorities to participate, and for unorganized areas to complete the necessary machinery. On August 20, Housing Administrator Raymond M. Foley sent to mayors of all cities of 25,000 or more population a 12-page preliminary explanatory statement to American cities.

Provisions

The statement outlines the slum clearance provisions of the act and prerequisites for participation by cities in the program. Other questions answered include (1) types of local projects that can be assisted, (2) kinds of work and redevelopment activity eligible for Federal assistance, (3) types of Federal loans that are available to cities for slum clearance projects, (4) provisions for private financing, (5) requirements as to Federal capital grants and local grants-in-aid, (6) legal authority required for local participation, and other requirements.

Mr. Foley said that the information will advise communities of the steps that must be taken to prepare for filing of applications. Drafting of application forms and regulations for the new program is awaiting final action on appropriations and the organization of a qualified staff.

12 Cities, 76,650 Units

Meanwhile, as of August 24, 12 cities had received Public Housing Administration approval of 76,650 units of proposed construction under the low-rent public housing feature of the act. The applications were based on applications submitted by local housing authorities having "ready" programs, and represent their initials shares of the national total of 810,000 units of public housing to be authorized for construction during the next six years.

Approved reservations contemplate 300 units for Orlando, Fla.; 10,000 for Detroit; 450 for Raleigh, N. C.; 20,300 for New York City; 750 for Yonkers, and 44,850 distributed among the following cities: Galveston, Norfolk, Chicago, Los Angeles, Memphis, Baltimore, Atlanta, and Albany (Ga).

Three of the housing authorities also requested preliminary loans to be used for planning the housing projects they expect to build. Orlando asked $15,000; New York, $2,180,000 and Detroit $1,150,000. All of the housing authorities given reservations are already operating low-rent public housing projects built under the previous program authorized by the U. S. Housing Act of 1937.

What and How

H&V readers who are seriously interested in getting into the details of the new housing program will welcome a new 30-page booklet, "A Handbook of Information on Provisions of the Housing Act of 1949," available at 15¢ per copy from the Superintendent of Documents, Government Printing Office, Washington 25, D. C.

Operations authorized under the various provisions of the act, together with a summary of the act itself, are included in the booklet, which is intended to provide in layman's language complete information on all phases of the program. The only provision of the act not covered is Title II, which is a temporary extension of certain existing Federal Housing Administration mortgage-insurance operations for which further continuation is provided in other legislation being considered by Congress.

"The information in this booklet does not attempt to be an exhaustive treatment of all details of the bill nor to answer all of the questions that have been or will be raised," Housing Administrator Foley explains. "It is intended primarily to highlight and amplify the major phases of the act which are of greatest interest to the general public. Some questions must await formulation of administrative policies and regulations authorized by the act."

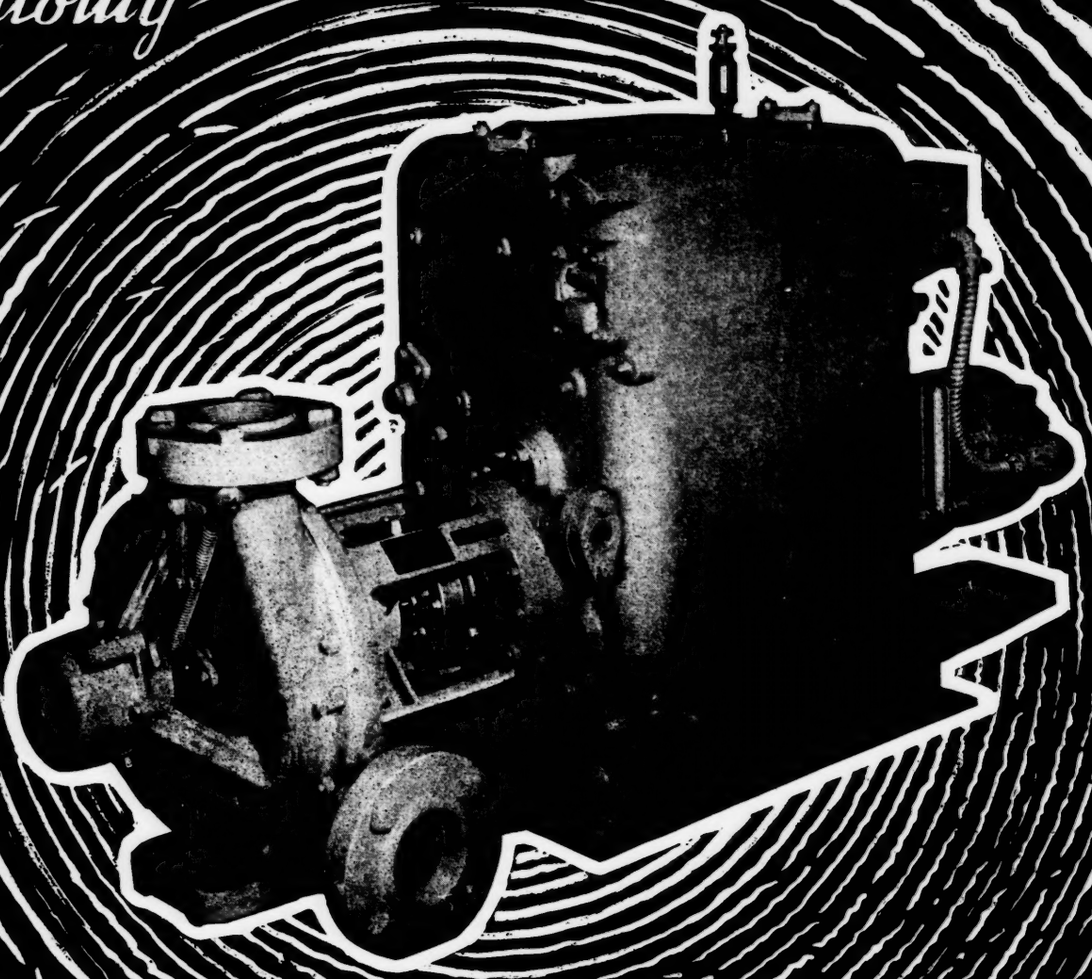
Names and Places

Since knowing whom to contact at the local level may be important to H&V readers, another booklet is of considerable interest. This one, published by the National Association of Housing Officials, 1313 E. 60th, Chicago 37, Ill., gives the personnel of all existing Housing Development Agencies and Research Organizations. Also included are several pages of historical and statistical data. Inasmuch as all projects must originate at the local level—with all planning and contracting at that level—this is indeed a list of key people. The booklet, Housing Directory, appears well worth its $5 price to those having need for individual local contacts. Inquiries concerning the booklet are customarily addressed to Miss Dorothy Gazzalo, Associate Director, NAHO.

New Purchase Edict

Another Washington development intended to channel business into areas hit by unemployment affects purchases by the military and 10 other Government agencies. Eleven areas were named in the initial directive from the White House to purchasing departments. Others will be added if, when, and as they develop. Firms operating plants in areas where unemployment appears unusually high are being invited to write to the Small Business Division, Commerce Department, Washington 25, for suggestions.

Centralized Heating Economy



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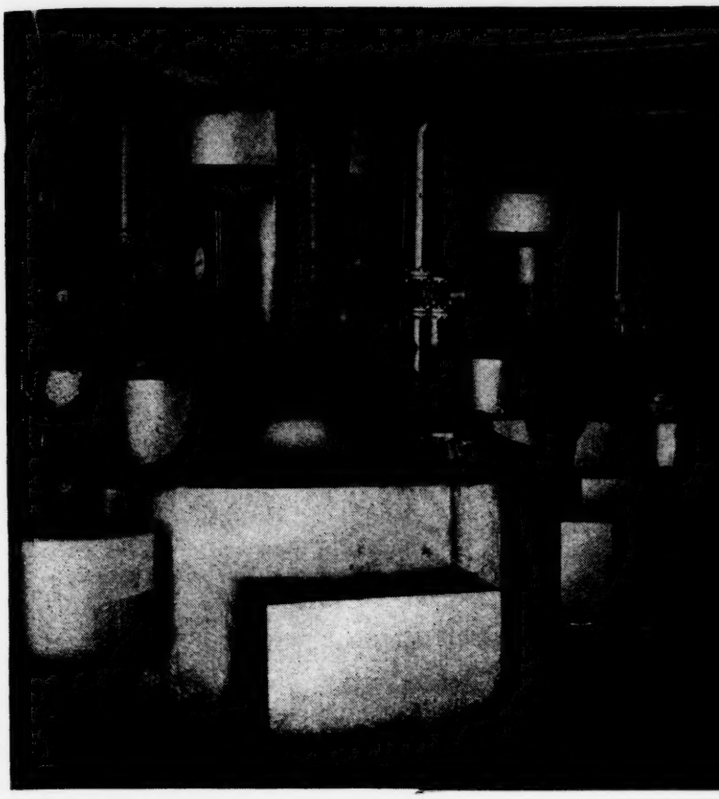


Refrigeration Requirements in the Manufacture of Cold Rubber

JOHN C. H. WENDES
Operations Manager, Synthetic Rubber Division,
United States Rubber Co.

About 200,000 long tons of cold rubber are made annually in the United States, and to produce this synthetic product large capacity refrigeration systems are required. An analysis is presented of the heat to be removed in the manufacturing process and the refrigeration necessary.

TO the ever-growing list of industrial applications and products made possible by refrigeration, may now be added the phenomenal synthetic substance termed cold rubber. This type of synthetic rubber, instead of being manufactured at the conventional temperature of 122F is now being produced at 41F or less—hence the terse descriptive label of cold rubber, although technically it is GR-S.

It is the result of the wartime quest to find a synthetic product to take the place of natural rubber. The natural product has fixed properties, while the synthetic variety can be altered almost at the will of the rubber chemist. Synthetic rubber produced at 41F or less is the equal of natural rubber in tensile strength and enlongation in tire tread stock and about equal to natural rubber in cracking resistance and abrasion resistance. Tests have proven that automobile tire treads made from low temperature synthetic rubber are superior to those made of natural rubber in wear resistance and provide 30 to 40% added mileage than previous synthetic rubber.

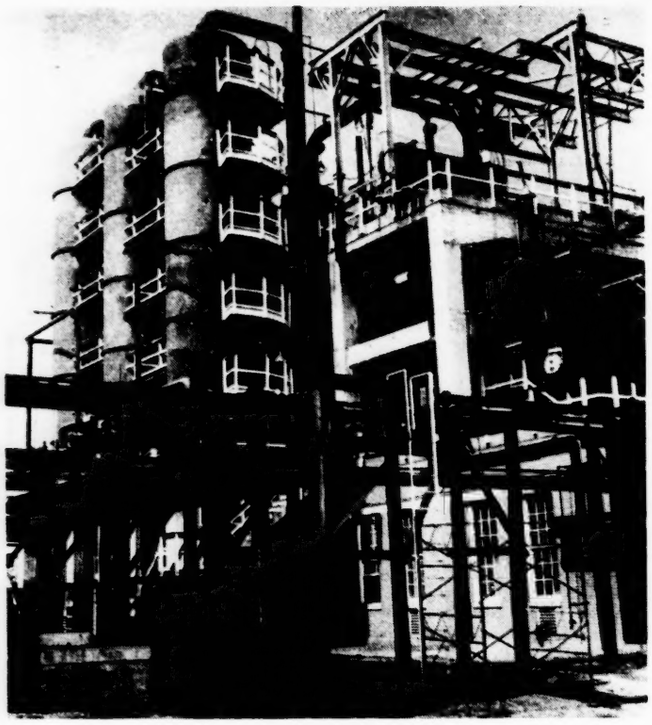
Normally, synthetic rubber latex is polymerized at a reaction batch temperature of 122F. Although it was discovered that rubber could be polymerized at a much lower temperature, the reaction time per batch was slowed down from 12 hours to as much as 10 days. However, by adding dextrose sugar, cumene hydroperoxide, sodium pyro-phosphate and ferrous sulphate, chemical reactions were speeded up so that rubber could be produced at 41F in 12 hours.

Large tonnage refrigeration equipment is necessary to produce the low temperature coolant for controlling the polymerization reaction in full scale plant manufacturing operation.

The refrigeration load is divided between the batch pre-cooling cycle and the batch reaction cycle. Reaction of low temperature rubber is not started until all the charged material in the reactors has been brought to a temperature of 41F, at which point an exothermic reaction takes place which is controlled by reactor cooling. Referring to Refrigeration Requirements and to Table 1, it will be seen that the amount of refrigeration required to pre-cool the 9,000 lb batch is nearly equal to the heat of reaction of three reactors in operation. By careful batch scheduling, 75 tons of refrigeration provides sufficient capacity to control three batches under reaction, or two batches under reaction while the third is being pre-cooled. This initial design premise has been justified in plant scale operation.

The equipment installed at the Naugatuck Synthetic Plant consists of a 75-ton 10-inch x 10-inch two-stage reciprocating compressor, motor driven. Based on 70F cooling water, the compressor is capable of producing an evaporator temperature of 5F at 150 lb per sq in condensing pressure at a rate of 75 tons refrigeration. The compressor discharges through an oil separator into an eight-pass 1,220 sq ft ammonia receiver. Liquid ammonia from the receiver is admitted by liquid level control into a six-pass 1,330 sq ft evaporator.

The cooling medium chilled in the evaporator is a 40% methanol water solution. The chilled coolant leaves the evaporator at temperatures varying between 10 to 15F, which temperature is selected depending upon the rate of reaction of the particular product



Styrene stripping towers at Borger, Texas. Each tower is 60 ft high and 9 ft in diameter.

TABLE 1—HEAT LOAD PER REACTION PERIOD

Heat Gain Item	One Reactor	3-Reactor Plant
	Btu per Hr	
Heat of reaction = $\frac{9{,}000 \times 575}{24}$	215,600	646,800
Agitation Horsepower input (net) = 10 10 × 2545 Btu per hp hr	25,450	76,350
Total	241,050	723,150
Coolant circulating pump Horsepower input (net) = 20 20 × 2545 Btu per hp hr		50,900
Coolant piping* = 800 sq ft × 70F × .075		4,200
Reactors* = 331 sq ft × 70F × .075	1,740	5,220
Coolant surge and storage tank* = 750 sq ft × 70F × .075		3,950
Heat load total, Btu per hr		787,420

*Insulation specification, 4 inches of cork.

being manufactured. The coolant is delivered to the three reactor jackets through instrument control valves, and the warm coolant returned to a 16,000 gal storage tank at a temperature of approximately 20 to 23F. Coolant is withdrawn from the storage tank by a pump which delivers it to the evaporator and the cycle is thus repeated.

Refrigeration Requirements

Polymerization Data

Total dry latex solids per batch, lb	9,000
Total weight (wet) charged per batch, lb	24,000
Final solids, per cent	40
Final conversion, per cent	85
Specific heat—(wet weight basis)	0.76
Reaction temperature, F	41
Charging temperature, F	75
Heat of reaction (dry weight basis), Btu per lb	575
Reaction Cycle:	
(a) Foreseeable time by Development Department, hr	30
(b) Time basis for calculations, hr	24

Heat Removing Capacity of Compressor

74.6 tons at coolant temperature leaving evaporator of 15F, with ammonia condenser water temperature at 70F. Capacity in Btu per hr 895,200

Contingency Factor

Excess heat removing capacity over calculated load, summer conditions, Btu per hr 107,780

Cooling Batch to 41F in Reactor

Total heat = 24,000 lb x 0.76 sp ht x (75 — 41) = 620,160 Btu.

Rate of Heat Removal

Over-all heat transfer coefficient, U = 50 Btu per hr (sq ft) (F) through S.S. clad reactor walls†

Mean temperature, coolant in jacket = 19F

Mean temperature of batch during cooling period = 58F

Jacketed area of reactor = 250 sq ft

50 x 250 x (58 — 19) = 487,000 Btu per hr.

Calculated Time Required to Cool

$$\frac{620{,}160}{487{,}000} = 1.3 \text{ hours}$$

Coolant Temperature Requirements

$Q = UA\ (t_b - t_c)$

Where U = coefficient of heat transmission through reactor wall, Btu per hr (sq ft) (F)

A = jacketed area of reactor, sq ft

t_b = temperature of batch, F

t_c = temperature of coolant, F

Q = total heat to be removed, Btu per hr

$$(t_b - t_c) = \frac{Q}{UA} = \frac{241{,}050}{50 \times 250} = 19.3\text{F},$$

mean coolant temperature

Batch temperature, F	41
Mean temperature drop, batch to coolant, F	19.3
Required mean coolant temperature, F	21.7

Design-mean temperature of coolant in jacket is 19F. Therefore, design conditions, 19F, satisfy requirements, 21.7F.

†Over-all heat transfer coefficients through glass coated reactor walls have been assumed to be 40, 34, and 25 Btu per hr (sq ft) (F) for 41F, 14F, and 0F reactions, respectively. The value of 40 for 41F reactions has been established experimentally. Limited experimental data at 14F indicates that a U value of 34 is reasonably accurate. A U value of 25 for 0 F reactions is definitely an estimate based on a continued decline of U at progressively lower reaction temperatures.

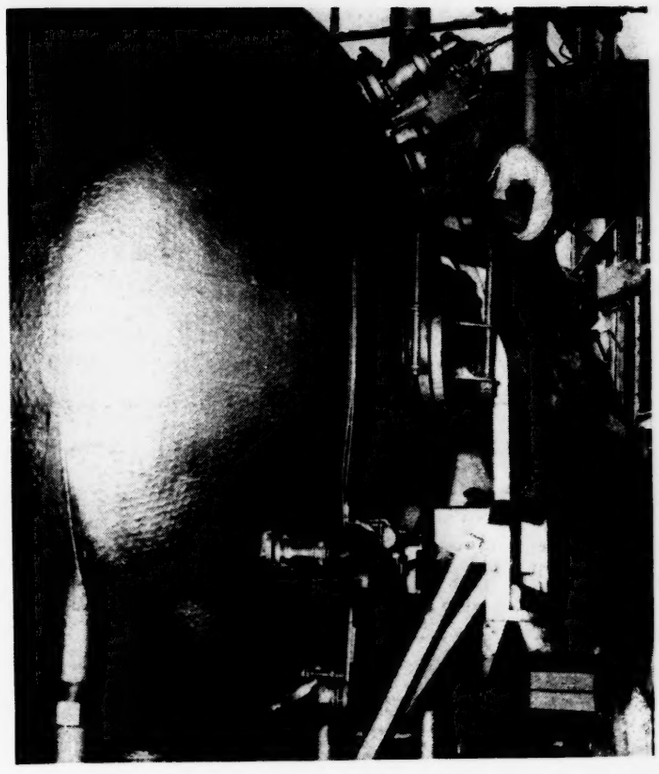
Safety Controls

The refrigerator is equipped with standard safety controls, including excessive low suction pressure and high discharge pressure and cooling water failure protection. Interlocked with these safety devices is an identifying trouble light on the panelboard and an enunciator in the control room. The combination of an alarm and signal light immediately advises the operator of the source of machine difficulty. The electrical and control system is of explosion-proof construction due to the proximity of the installation to the storage of hazardous materials. The compressor is also equipped with 1/3 and 2/3 capacity unloading valves which stabilize compressor suction temperature and evaporator temperature during load fluctation.

Temperature control of the coolant is obtained by a temperature recorder-controller having four thermocouples located in the 16,000 gal coolant storage tank.

Operating experience has shown that regulation of the outgoing brine temperature is effectively obtained using the brine storage tank temperature as a criterion. Since the reactors are equipped with temperature instruments regulating the amount of coolant admitted to the jackets, a small variation in the chilled coolant is compensated by valve positioning of the individual reactor control valves.

The entire liquid ammonia system, including evaporator and ammonia suction piping, as well as the 16,000 gal methanol storage tank and coolant piping, is insulated with vegetable cork and a plaster coat for weatherproofing. The entire installation is the outdoor type with a housing over the compressor being the only sheltered portion of the equipment.

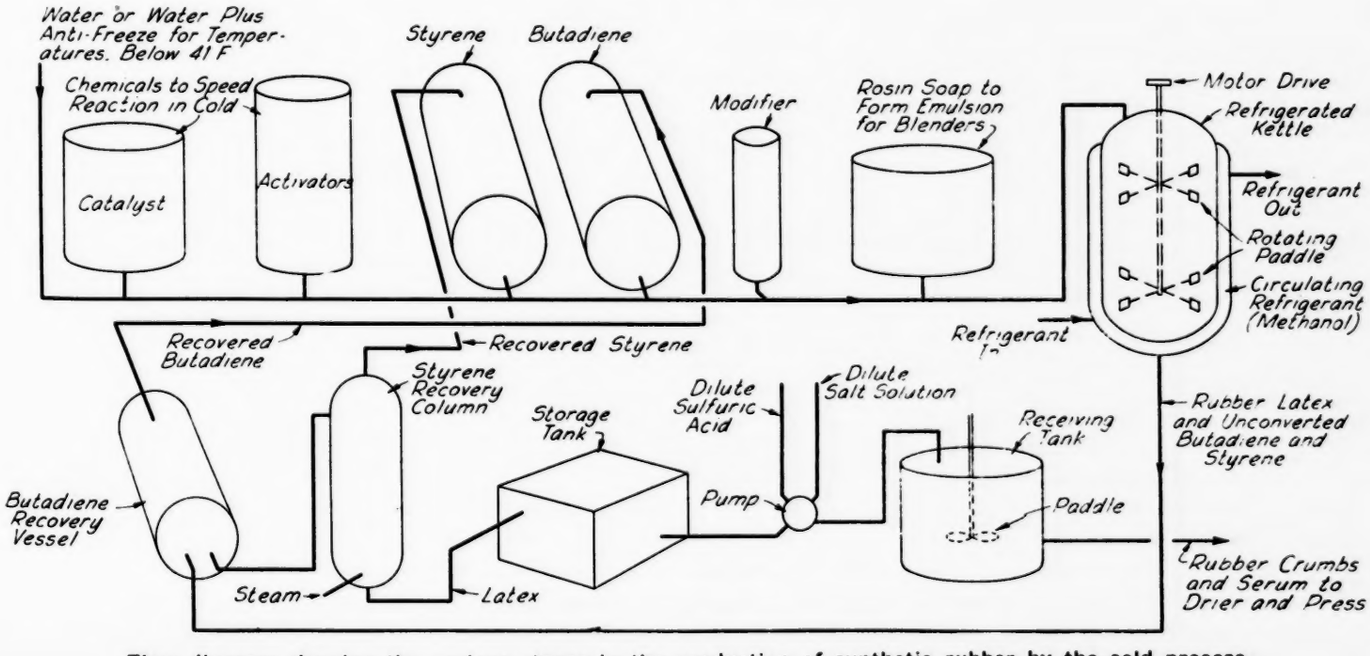


Insulated butadiene stripping tank provided with automatic latex control.

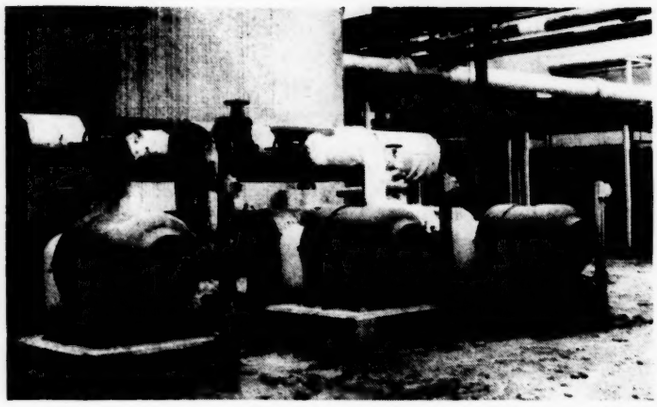
Synthetic Plant at Borger, Tex.

At the United States Rubber Co. plant at Borger, Tex., 1,000 tons of refrigeration are employed. Cooling water temperature is 80F. The system includes five Cooper-Bessemer engines rated at 302 hp that burn natural gas. The gas consumption is 8,500 Btu per hp hr. Ammonia is used, with each engine and compressor unit rated at 200 hp. Other data regarding this refrigeration system is given in Table 2.

A discussion was held regarding insulation to be used at the synthetic rubber plants at a meeting in Amarillo, Tex. From the standpoint of reducing heat pick-up in the coolant system, insulation would not be justified at the temperatures at which the synthetic rubber plants intend to operate if power costs are low.



Flow diagram showing the various stages in the production of synthetic rubber by the cold process.



Coolant storage tank, piping and circulating coolant pumps at the Borger, Texas, plant.

It can be justified from the standpoint that it will prevent condensation of moisture on the cooled metal surfaces and thus eliminate the continual dripping of water in the areas involved. Although this condensation would be especially severe in the Gulf Coast area, a two-inch insulation would be sufficient. However, when the humidity is high, it is recommended that a 3-inch insulation be used for pipe lines and 4-inch insulation on the reactors to prevent sweating.

While both vegetable and mineral cork must be protected from moisture, foam glass is impervious to moisture. It was found that, by using 5 inches of foam glass insulation, the heat loss would be equivalent to 7 inches of vegetable cork. A sealing compound improved the strength of the foam glass blocks.

Extent of Refrigeration

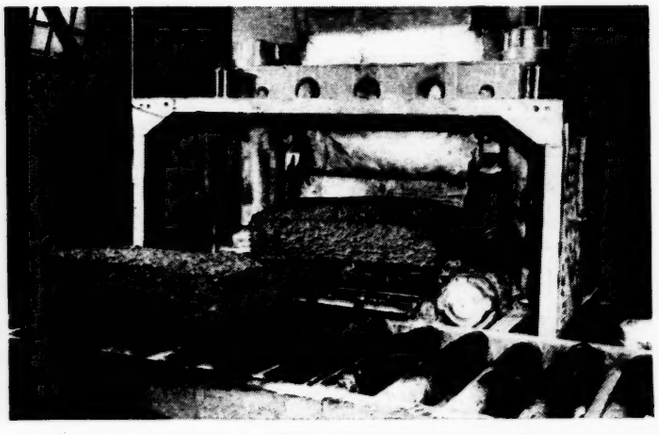
To obtain some concept of the amount of refrigeration employed in the cold rubber process, the following tabulation lists the total refrigeration capacity installed at various plants, or in the process of being installed.

United States Rubber Co., Borger, Texas

Cooper-Bessemer gas engines, ammonia gas compressor—1,000 tons

United States Rubber Co., Naugatuck, Conn.

Worthington two-stage electric motor-driven reciprocating ammonia compressor—75 tons



Bales of cold rubber emerging from the press onto the conveyor, ready for shipment.

TABLE 2—DETAILS OF PLANT AT BORGER, TEXAS

Cooper-Bessemer Engines	
Number of engines	5
Fuel used	natural gas
Horsepower	302
RPM, compressors	400
RPM, generators	450
Gas consumption, Btu per hp hr	8,500
Number of cylinders	6
Diameter of cylinders, inches	9¾
Length of stroke, inches	10½
Method of starting	high pressure air
Ammonia Compressors	
Method of drive	Integral-connected to engine crankshaft
Number of stages	2
Diameter of low pressure cylinders, inches	17
Diameter of high pressure cylinders, inches	12½
Tonnage per engine and compressor unit	200
Engine Water Cooling System—High Volume, High Velocity Type.	
Pumps, electric driven, 500 gpm (number)	2
Pump, engine driven, 500 gpm (number)	1
Method of cooling	Heat exchange with plant cooling water automatically controlled
Inhibitor used	dichromate
Evaporators	
Number of evaporators	5
Square feet, total	12,050
Tons refrigeration	1,049
Condensers	
Square feet, total	11,504
Tons refrigeration	1,048
Gallons of ammonia per minute	89
Cooling water required, gpm	2,850
Coolant Circulating System	
Coolant used	35% methyl alcohol and 65% water
Freezing point	—25F
Capacity of system, gallons	25,000
Capacity of storage tank, gallons	12,000
Flow rate, gpm	3,000
Number of centrifugal pumps	3
Capacity of pumps, gpm	1,500
Head, in feet	100
Electric pump drive, hp	60
Insulation	
Fiberglas, inches thick	4
Charge Precoolers	
Number of spray charge precoolers	2
Square feet, each	1,550
Type control	pressure and temperature

Goodyear Tire & Rubber Co., Houston, Texas

4 Worthington horizontal reciprocating ammonia compressors—1,080 tons

Goodrich, B. F. Co., Port Neches, Texas

3 Carrier centrifugal, steam turbine-driven 4,500 rpm Freon compressors—1,200 tons

Firestone Tire & Rubber Co., Lake Charles, La.

3 York centrifugal Freon compressors—1,200 tons

Copolymer—Baton Rouge, La., Plant

5 Clark gas-driven ammonia compressors—950 tons

General Tire & Rubber Co., Baytown, Texas

York ammonia absorption units—750-1,000 tons

Acknowledgments

Thanks are due all the members of the Subcommittee on Plant Revisions of Operating Committee, O.R.R., for data used.

Navy Installs Air Conditioned Television Studio

E. STERNBERG
Fred L. Moesel Associates, Consulting Engineers, New York City

Air conditioning a television studio is complicated by exceptional lighting and equipment loads especially in the spring and fall, when controls may call for heating and then cooling during a single program. The author describes the Navy's first studio for class instruction and shows how noise and air distribution are handled.

THE U. S. Navy recently put into operation the first educational television network and began a weekly schedule of ordnance and gunnery lectures which are televised from a new studio at the Special Devices Center, Port Washington, Long Island.

At present, the programs are received and utilized at one base, Merchant Marine Academy, Kings Point, New York, an air-line distance of 4.7 miles from the transmitter.

Facilities are now ready and will be utilized shortly to bring the same instructional programs to Naval Air Reserve Squadrons at Squantum, Mass.; Willow Grove, near Philadelphia; Floyd Bennett Field, New York; and Anacostia, near Washington, D. C. The television hook-up will also be used soon at a number of eastern colleges and universities.

The new television studio at Port Washington occupies a tower-shaped corner of what was once the stables at Castlegould, huge estate of the late Howard Gould. The particular spot in the stables chosen for the studio proved to be ideal because the tower adapted itself to a multiple-level arrangement, including working area, operator's gallery and observer's gallery.

Studio construction was designed by Arthur E. Ramhurst, Montclair, New Jersey—architect; Fred L. Moesel Associates, New York City, were consulting engineers on the project; and Balaban & Gordon, New York City, were the general contractors.

The Port Washington installation is believed to be the first television studio to employ fluorescent lighting for base illumination. It probably is the first installation where the walls are covered with pierced Transite over three layers of rock wool, graduated in thickness. This arrangement has proven to have distinct advantages in controlling sound.

The air conditioning installation was designed for all-year operation to meet the following requirements:

(a) Continuous ventilation of the studio, control room, spectators gallery, and equipment room;
(b) Cooling and dehumidification during summer;
(c) Heating during winter operation which would be switched automatically to cooling because of the very high lighting load.

Auxiliary electric heaters under thermostatic control were provided in certain areas to maintain comfortable conditions with the refrigeration in operation. The installation was zoned for the studio, control room, and spectators gallery, each with thermostatic control.

Major air conditioning equipment is located in a room below the studio and consists of a 30-ton condensing unit with several steps of automatic capacity

control, supply fan, direct expansion cooling coils with several independent circuits each automatically controlled, steam heating coils with automatic control, washable air filters, outside and recirculating air connections, automatic dampers and auxiliaries.

Because the studio required an extremely low sound level, actually lower than the usual broadcasting studio level, sound absorbers of special design were installed in both the supply and recirculating air ducts. In addition, acoustically-lined ducts were extensively used, duct fittings and turning vanes were designed for minimum turbulence and low air velocities were specified. In actual operation, a person can be within a few feet of a diffuser yet cannot tell when the system is in operation.

The pneumatic temperature control system automatically maintains constant zone temperatures and controls the compressor unloading valves and heaters.

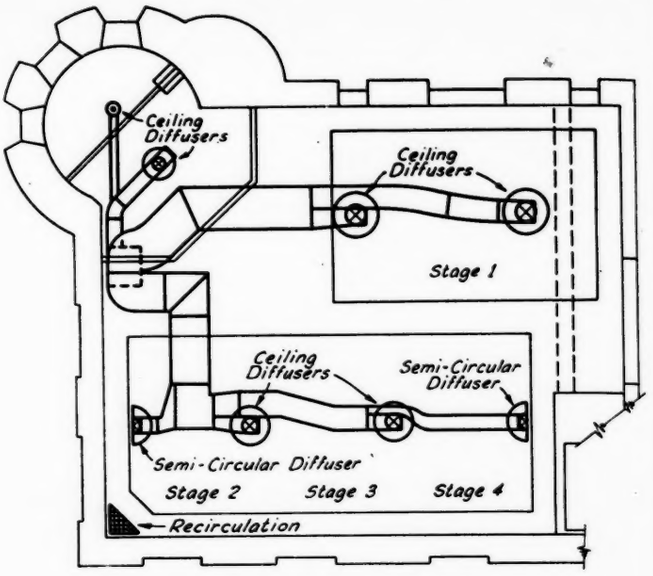
Air distribution presented a major problem—it was necessary to provide draftless diffusion in spite of the very high rate of air changes required by studio lighting load. The number of diffusers had to be held to a minimum so as not to interfere with stage lighting grids and overhead catwalks. Mounting height had to be given careful study in order to avoid air stream interference; and selection of proper size diffusers had a vital part in holding air noise to a minimum.

Diffusers were finally located between the three television studio stages, below the level of the lighting grids, using both 360-degree and 180-degree air patterns. Each diffuser has adjustable internal deflectors and volume control dampers, and these were used in establishing the final air patterns. The entire problem of air diffusion was the more complicated because of the size and location of the lighting grids and suspended catwalks.

Perhaps the most extreme conditions to be handled by the air conditioning system at the Port Washington studio come in spring and fall. It is then that the studio is often cold on starting work so the thermostat calls for heat. After the lighting units are on for a short period, the temperature rises to a point where refrigeration is required to maintain comfort.

As mentioned previously, the control room is built

Navy's T-V stage. Note heavy lighting and electronic heat gain and dropped diffusers for air conditioning.



Plan of studio at upper level.

in the tower of the stables and is at a higher level than the main working area of the studio. Beneath the control room is another room in which auxiliary electronic equipment is housed in metal cabinets. The floor separating control room from equipment room is laid on Robertson Q steel corrugations. Wiring from auxiliary equipment cabinets to control consoles is conveniently laid in these corrugations which serve a secondary purpose as conduits.

The equipment cabinets in the room below the control room contain a large number of electronic tubes which generate huge quantities of heat. In order not to burden the main air conditioning system with this waste heat load, a separate exhaust system was installed to discharge the heated air directly to the outdoors, with a separate conditioned air supply to the room to maintain comfortable conditions.

Total lighting in the new television studio at Port Washington adds up to 60,000 watts, exclusive of the control room and other auxiliary spaces. Under the combination of fluorescent and incandescent illumination, the U. S. Navy will produce programs which will include lectures, demonstrations, round tables, and dramatizations. Diagrams, maps, film strips, models, motion pictures, and other devices will be utilized in order to heighten interest and teaching values.

The Navy is also developing a television classroom most suitable for receiving the television programs at instruction centers. The design will be aimed at producing a layout suitable for prefabrication in large numbers for operation in all types of locations. Tests will determine size and shape of room, seating arrangements, acoustic properties, room illumination, size of screen, and locations for microphones to be used by trainees in questioning the instructor.

Cameras, communication equipment, monitoring consoles, slide and film projectors, fluorescent lighting, and large-screen receivers for the new Navy television studio were supplied by General Electric Co. Anemostat Corp. of America designed and built special air diffusers for the installation. Minneapolis-Honeywell Regulator Co. supplied the control system. Johns-Manville produced the Transite and rock-wool.

An Improved Method for Supporting Horizontal Storage Tanks

FRITZ KRAMRISCH

Structural Engineer, Albert Kahn Associated Architects & Engineers, Detroit, Mich.

MODERN manufacturing plants require large quantities of gases and liquids for fuel and other purposes. These materials are generally stored for service in horizontal tanks above or below grade, according to the Underwriters' safety requirements.

Horizontal storage tanks below grade are generally supported by a continuous concrete slab to which the tanks are anchored against uplift. These slabs extend all over the plan-area of the tanks. Concrete is tucked into the fillets underneath to provide a continuous cradle. The backfill has to be tamped thoroughly for lateral support of the tanks to prevent excessive deformation.

In similar manner horizontal storage tanks above grade are generally supported by several relatively closely spaced cradles or slings, each of them resting on separate piers and footings and supporting the tank only over a part of its bottom.

An improved method of supporting horizontal tanks is that described and illustrated in this article. An installation is shown in Fig. 1, which is the open pit of an underground tank farm for the Engine Building of the General Motors Corporation in Pontiac, Mich. There are nine horizontal 12,000 gallon tanks for the storage of oil, gasoline, and kerosene. The tanks are of 10 ft diameter, 22 ft long out-to-out, and of 5/16 inch wall thickness. The center of the tanks is 9 ft below grade. The tanks have shallow dished heads of 3/8 inch thickness.

The farm is subdivided into three groups, as shown in Fig. 2. Three tanks are under a trucking pavement, three tanks under a pump house, and the remaining three under free grade.

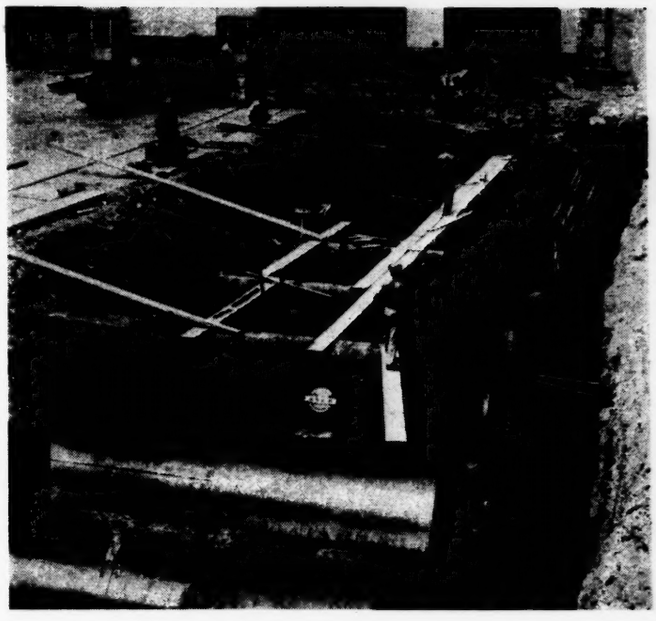


Fig. 1. Installation at Pontiac plant of underground tanks, supported as described by the author.

This installation differs from common practice in that each of these tanks is supported by only four lugs welded to the tank near the tank head. The lugs sit on independent piers and footings and are anchored to them. Details of the lug are shown in Fig. 3, 4, and 5, and will be described later. The same detail has been used throughout for all nine tanks.

This design takes advantage of the tank to act, if properly supported, as tubular girder in longitudinal

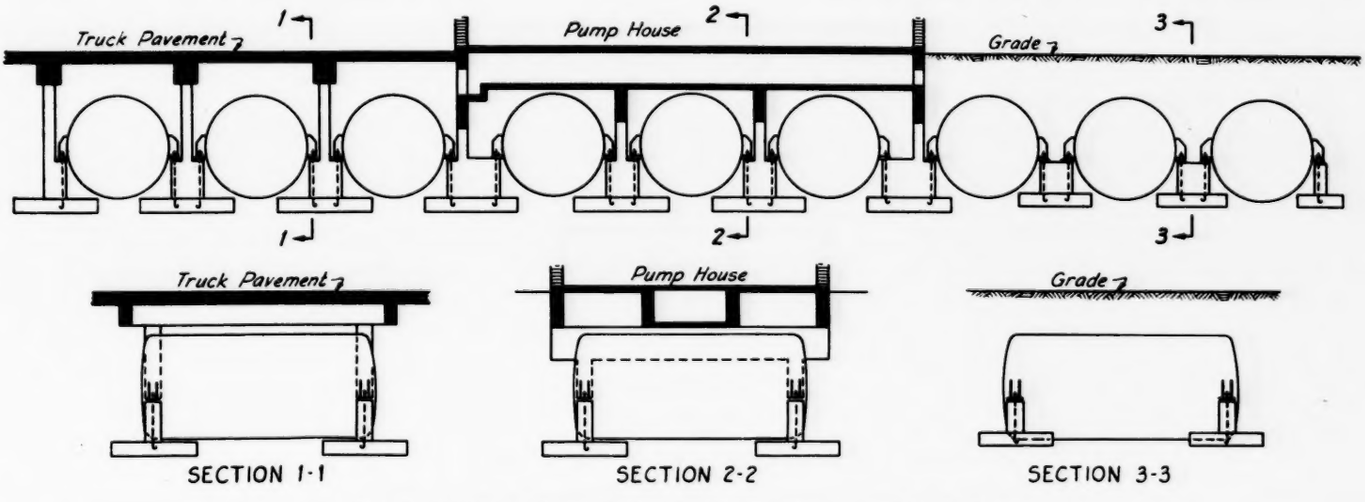


Fig. 2. Sections through the Pontiac underground tank farm.

Fig. 3. Lug welded to tank in the Pontiac installation.

direction. If stiffly supported along its whole perimeter by full discs or ring girders, such a tank will act as a membrane (shell) and stay round between the supports. Loads applied continuously over the surface produce, mainly, direct stresses as longitudinal beam stresses and ring stresses; but no bending stresses perpendicular to its wall. Shear stresses acting tangentially to the circle transmit the loads from the walls into the supports.

Any intermediate support, such as cradles, extending only over a part of the perimeter, produces circumferential bending stresses which amount to multiples of the direct fiber stresses, especially near the tips of the supports. In order to reduce these local stress concentrations, cradles have to be spaced at relatively close distances. But the closer the spacing of the cradles the smaller the possibility for a tank to act longitudinally; finally, in the case of a continuous cradle, any shell action is prevented and the tank is forced to act as an arch which represents a very unfortunate structural condition for the tank due to its thin wall.

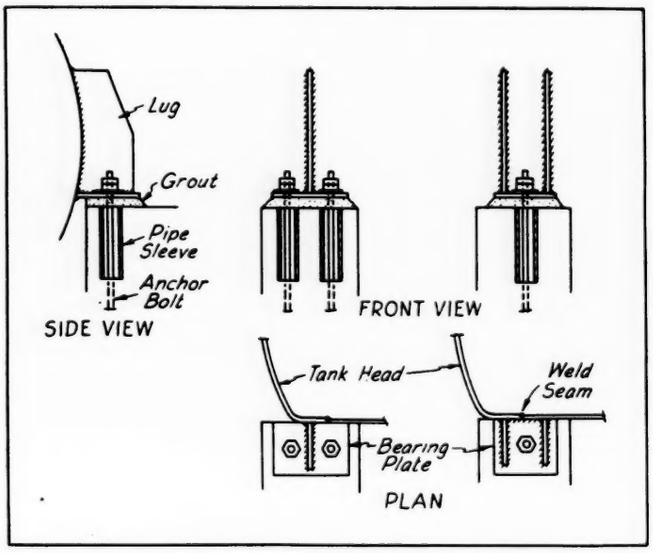


Fig. 4. Typical lug details.

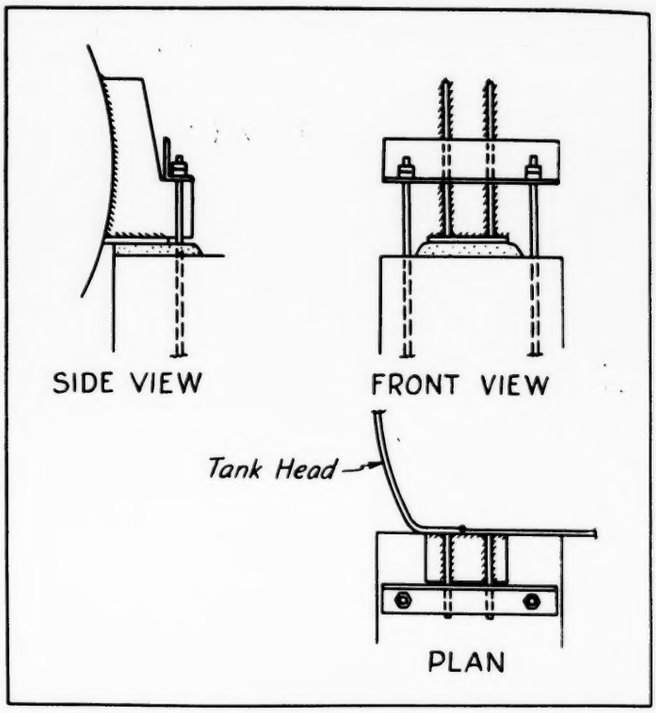


Fig. 5. Details of lug which allows for deviation in tank length.

The fundamental requirements to make the tank act as a tubular girder can easily be obtained by considering the end walls as stiff discs and by placing the supports into the same plane or very near to it. This way the tank heads not only maintain the shape of the tank but also take the moments produced by the action of the lug support. Flat heads or shallow dished heads (underground) work best although standard dished heads may be used also. If intermediate supports are required, they shall be designed as stiff rings made of bent sections or cut plates extending all around the tank.

The best place for the application of the supports is at the ends of the horizontal diameter where the shear stresses reach their maximum. The support, itself, is a lug, as shown in Fig. 4, and consists of one or two vertical plates welded to the tanks at mid-height with a horizontal bearing plate underneath. If one vertical plate is used it shall be welded directly to the tank head; two vertical plates best straddle the weld seam between tank head and tank wall. The same detail applies to tanks above and below grade.

Theoretical investigations show that bending moments in the tank supporting ring or end wall become a minimum if the support acts at a distance of 0.04 R (R = Radius of tank) outside the tank wall. It is, therefore, advisable to design the bearing plate so as to establish the center of the support as close as possible to this value.

Anchor bolts secure the tank to the foundation and have to take any resulting uplift if tanks are built underground. Pipe sleeves around the anchor bolts in the upper part of the pier give flexibility to the bolt and aid erection. In order to provide for small deviations in the tank length, seats and anchor bolts, at least at one end, may be designed as shown in Fig. 5.

Tank supports designed as described in the foregoing permit the design of tanks above or below grade as a beam with tubular cross-section whether for a simple span or continuous over several supports. Besides the economy which might result from a thinner tank wall and a better stress distribution, the following savings can be enumerated against the extra costs of the lugs and the welding of them to the tank.

Tanks Above Ground

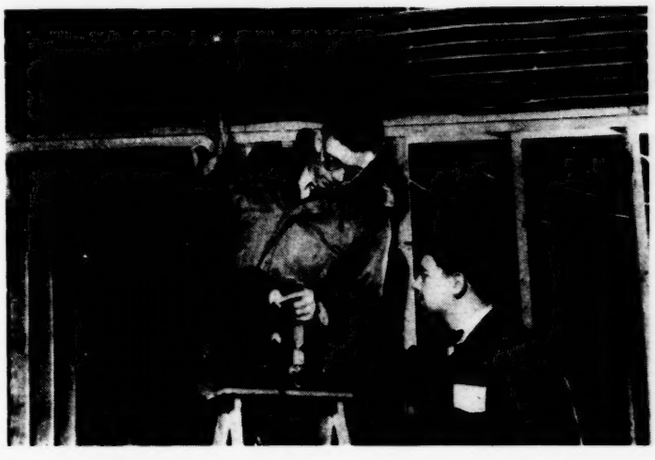
1. Omission of intermediate supports (cradles and footings).
2. Supports consist of straight piers instead of cradles, which are expensive in formwork and reinforcing. The piers are easier to level off to exact elevation than the curved cradle seats.
3. Easy erection.
4. Installation and maintenance are much improved because tank bottom is more accessible.

Tanks Below Ground

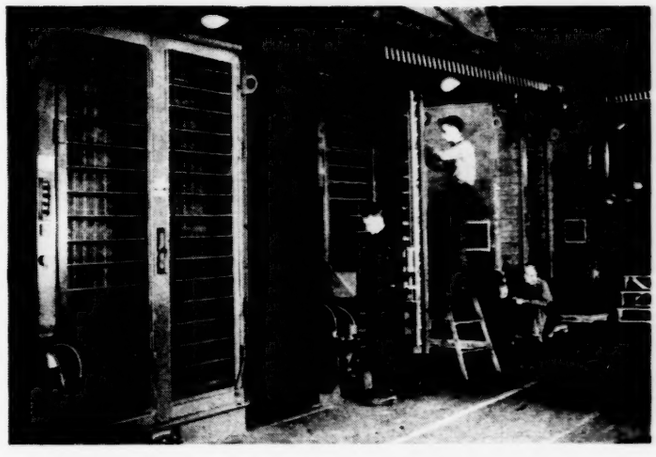
1. Reduced excavation in size and depth (single footing vs. continuous slab, single footings can be raised between tanks).
2. Less concrete in single footings as in continuous slab, although material and form for piers have to be added.
3. Omission of concrete fill to be tucked underneath tanks.
4. Omission of anchor straps.
5. Easy erection.
6. Increased durability because free tank bottom permits inspection and repair of protective coating after tank is set.
7. No special tamping of backfill required to support tanks laterally.

Designs similar to the one referred to and described at the beginning of this article have successfully been used at several other plants.

Picture Paragraphs

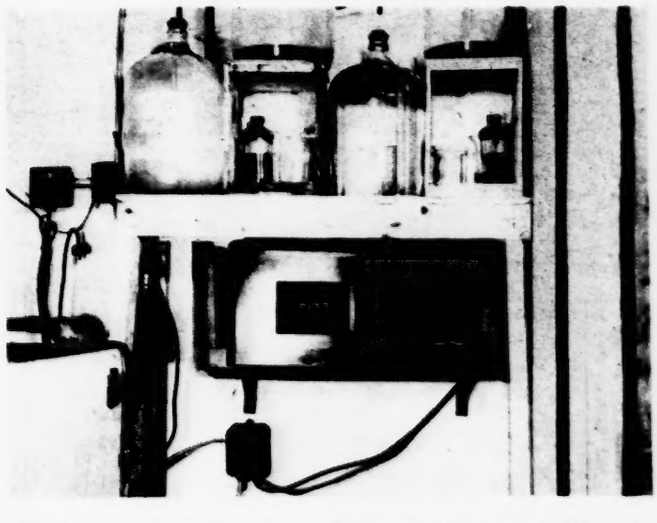


To test for leaks in a radiant heating panel in his new home, William E. Herrmann of General Electric's Special Products Division used a GE Type H leak detector. Tube was first filled with Freon and joints then probed with halogen-sensitive tip.



Electronic air cleaners for steel mills during final stages of assembly at Westinghouse Sturtevant Division, Hyde Park plant. Units are rated at 36 tons of air per hour. Single control takes unit out of service, washes cell bank and applies fresh adhesive.

The New Haven Railroad's passenger cars will be equipped with activated carbon air recovery panels which absorb odors and permit recirculation of one-half return air. Electrician in photo is replacing activated carbon unit.



Window type unit air conditioners find application in photographic dark rooms. This Frigidaire $\frac{1}{2}$ hp unit maintains a constant 70F in the color film processing room at Thaxton-Simonds, Decatur, Ga. *(More Picture Paragraphs, p. 83).*

Flat Patterns for Round Elbows

H. DAISLEY
Ray Daisley & Co., Lindenhurst, N. Y.

A simplified method is presented for laying out patterns for two types of 90 deg elbows.

THE book method for developing the pattern of a round 90 deg elbow involves the laying out of the side view and end profile, and the developing of the flat pattern by projecting equal spaces from the end profile into the first section of the side view. This side view is then unfolded in the conventional manner into a flat section.

The purpose of this article is not to show conventional methods which are common in the trade, but to present a short method which circumvents all of the preliminary work and makes it possible to lay out the flat pattern directly on the metal with the aid of a little mathematics. If the layout man can use a slide rule, this calculation can be computed in a matter of minutes.

To use the patterns illustrated, it must be kept in mind that all of the figures shown are factors and must be converted to dimensions by multiplying each by the diameter of the elbow. This applies also to the 1½ throat radius, that is, a 10-inch diameter elbow would have a 15-inch throat radius.

The 1½ throat radius was selected as the most desirable for the handling of air. If a different radius is desired, the factors can be changed by adding factor *B* shown in Table 1 to the factors shown for the miter line. This factor was found from the following formula:

5-Piece Elbow

$$\text{Factor B} = \frac{0.300\,R}{1.5} - 0.300$$

7-Piece Elbow

$$\text{Factor B} = \frac{0.197\,R}{1.5} - 0.197$$

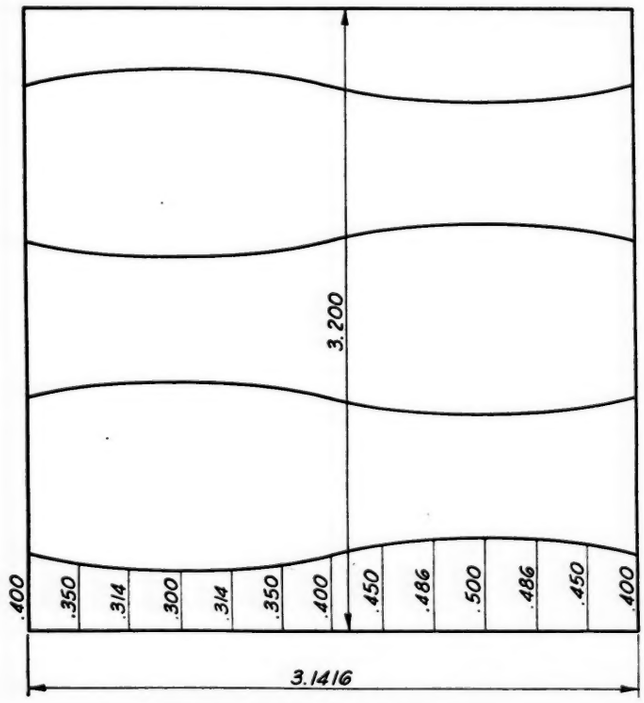
Where *R* equals revised throat radius.

The circumference factor will not change. The length factor will change by adding eight times factor *B* for 5-piece elbows and twelve times factor *B* for 7-piece elbows. All of the factors are net and can be used for welded elbows.

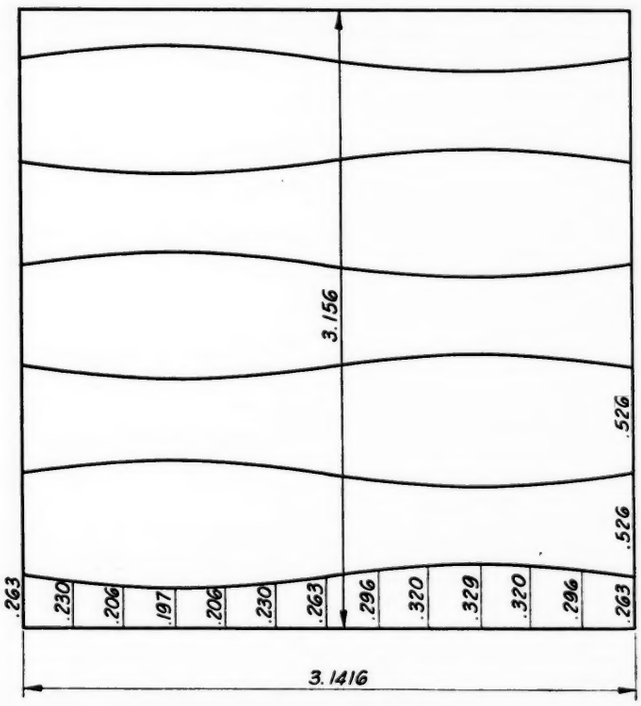
For riveted, peened, or spot welded elbows add the proper seam allowances.

TABLE 1—FACTOR B FOR REVISED THROAT RADIUS

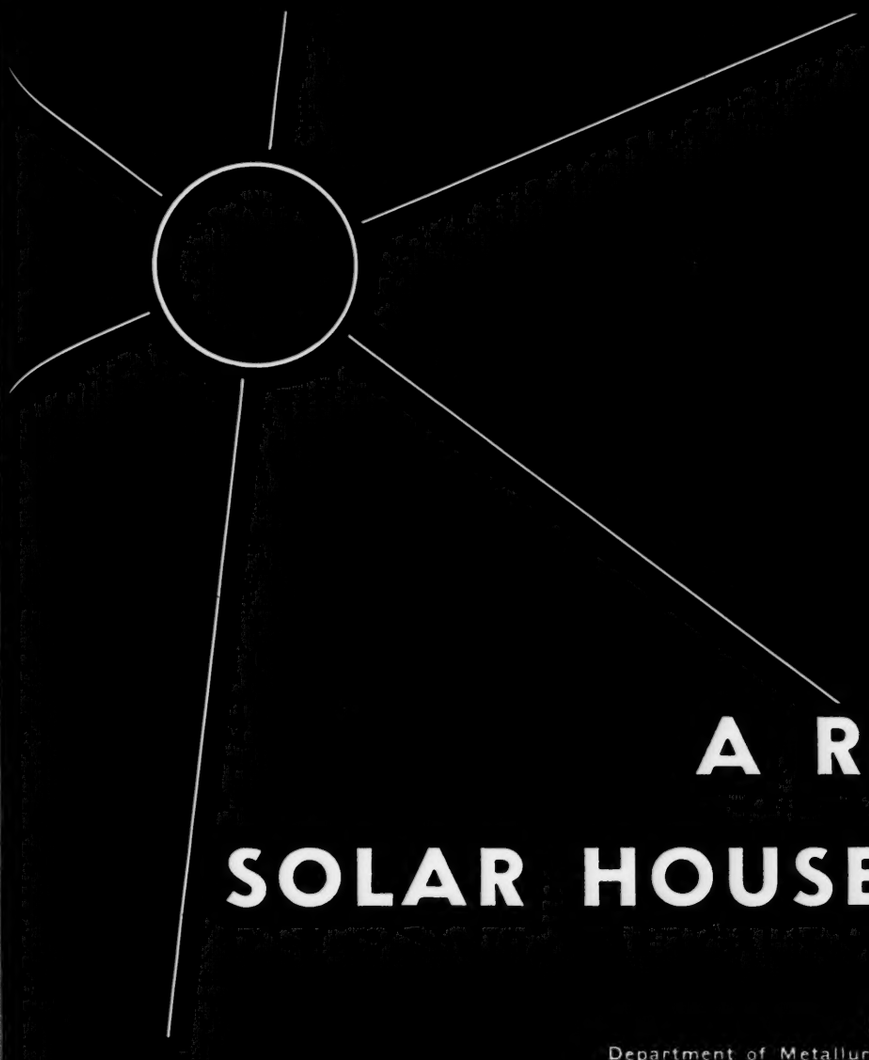
Throat radius, Diameters	Factor B	
	5-piece Elbow	7-piece Elbow
1	—0.1	—0.065
2	0.1	0.065
3	0.3	0.195
4	0.5	0.327
5	0.7	0.458
6	0.9	0.589
7	1.1	0.720
8	1.3	0.851
9	1.5	0.982
10	1.7	1.113



Pattern for 5-piece 90 deg elbow



Pattern for 7-piece 90 deg elbow



A REVIEW OF SOLAR HOUSE HEATING

MARIA TELKES
Department of Metallurgy, Massachusetts Institute of Technology, Cambridge, Mass.

A Review of Solar House Heating

MARIA TELKES
Department of Metallurgy, Massachusetts Institute of Technology, Cambridge, Mass.

Various methods of solar house heating are summarized in their relation to the efficiency of collecting and storing the available solar energy.

THE age-old dream of keeping warm enough during the winter and comfortably cool during the summer, has been the subject of most Utopias. To use the sun for this purpose has tantalized many minds and various schemes have been advocated in the past. Any plan based upon solar energy for house heating, must face and solve the following problems:

(1) Collection of solar energy. Winter sunshine must be collected, efficiently, simply and economically.

(2) Storage of solar energy. It has been shown definitely that storage of summer sunshine for winter use is not economical (1).* It is necessary to store solar energy, received during clear winter days, for the inevitable dark days when no solar energy can be collected. It is not economical to attempt capturing the last Btu of collectible sunshine; it is preferable to store efficiently the amounts available on clear, or partly cloudy days.

(3) Distribution of stored solar energy. The stored heat must be available when called for by a thermostatically controlled distributing system that is simple to operate, with minimum attention from and disturbance to the occupants. It is important that the house should not become overheated, especially during the rapidly changing weather of spring and autumn. Finally, it is important that the solar heating system should operate only during the winter and most definitely not during the summer.

What Has Been Done?

It was relatively recent, during the last century, that large enough glass window areas could be acquired at an economical cost to admit winter sunshine. The size and importance of windows have been increasing and with them the attention paid to the sun shining through the windows (2-5).

Solar houses were first popularized in this country about 1930. Experiments at Purdue University, Lafayette, Ind., under the direction of F. W. Hutchinson, were planned to settle the question: How much fuel actually can be saved? In a series of articles (7-11) the results of two identical test houses were compared. One of these, the "orthodox" house had the usual window area, while the "solar" house had a greater area of glass on the south side. In both houses two glass panes were used, with sealed air space between them. Both houses were electrically heated, to avoid human errors in coal stoking. They were thermostatically maintained at identical temperatures. The Purdue houses were not occupied during the tests and no attempts were made to control the excessive heat losses through the glass during the night.

Results indicated, surprisingly, that the Purdue solar house required about 16% more fuel heat than did the orthodox house during a December-January test period. It is obvious that a great deal of sunshine is admitted through large, south-facing windows on clear days and even on partly cloudy winter days, with the result that fuel is saved only while the sun shines. The house may often become overheated. However, at night and on cloudy days, the large windows dissipate a great deal of heat.

According to F. W. Hutchinson, the large-windowed solar house requires a larger than usual fuel-burning furnace, than does its conventional-windowed counterpart. The Purdue results apply only to the local conditions and different results may be obtained elsewhere.

Architectural designs illustrated in "Your Solar House" (12) may, or may not save considerable amounts of fuel, depending upon geographical latitude and also upon the latitude used in interpreting the word considerable.

Large heavy walls can store heat. The cyclic variation of wall temperatures, especially on the south side of buildings, has been studied (13) (14). The heat storage capacity of many a thick-walled old building has been obviously noticed, as well as the relatively cooler summer comfort of such houses.

Deliberate storage of solar heat has been used in solar water heaters, increasingly popular in Florida and California (15). All that was required was a heat trap on the roof, consisting of a flat tank or zig-zag arrangement of pipes, in a well insulated box, covered by one or two air-spaced glass panes. Water circulated in the pipes, became heated by the sun and accumulated in an insulated storage tank, to be used as required (16).

An enlarged version of the solar water heater was used to heat a two-room test structure built at Massachusetts Institute of Technology, during 1939-1940 (1). The 17,000 gal insulated tank occupied the entire basement. A similar house, occupied by tenants, has been completed recently at M.I.T. with a 1,200 gal water tank located in the attic.

G. O. G. Lof (17) (18) conducted solar heat collection and storage experiments at the University of Colorado. He covered about one-third of the roof of his own house with a solar heat collector, circulating air through it and blowing the warm air directly into the rooms, or into a heat storage duct, filled with crushed rock. During the first season a fuel saving of

*Numbers in parentheses refer to the bibliography at the end of this article.

20% was attained. Heat transfer problems of storage in crushed rock were summarized by Lof (19). The amount of heat storage was limited to the heating requirements of one day.

Simple methods of solar heat storage, using water, or rocks, are based on the specific heat effect. A new method for storing solar heat has been suggested by M. Telkes (6). This uses the heat of fusion, or heat of transformation. It is well known that all materials, when melted, require a rather large amount of heat to change their solid forms into their liquid forms. While the melting or fusion process progresses, the temperature of the material does not change but remains at the melting point.

The magnitude of this effect can be illustrated by the well known fact that 144 Btu are required to melt one pound of ice to ice cold water. The same amount of heat imparted to one pound of ice cold water, at 32F, will increase the temperature of the water to 32 + 144 = 176F (neglecting factors as lateral heat losses).

Most materials have a well defined melting point and their heat of fusion is a known physical constant. The important problem was to find an inexpensive and easily available material, with a melting point convenient for solar heat storage and with a relatively large heat of fusion. The principles of adapting this method for house heating have been analyzed in a previous article (6) and several methods have been proposed.

How Much Sunshine Can We Expect?

The United States Weather Bureau has exact records of sunshine, dating back many years. These records cover the following data:

(1) Sunshine hours. The monthly total of sunshine hours for more than 200 stations is published regularly by the Weather Bureau. Maps have been printed giving the number of sunshine hours for each month, as an average for the past 50 years. The instrument used records sunshine only when the amount of solar energy is more than 82 Btu per (sq ft) (hr). To account for the early morning and the late afternoon sunshine, a correction factor is added. Weather bureaus of Europe and other parts of the world use the Campbell-Stokes recorder, a slightly different instrument, recording sunshine in excess of 73 Btu per (sq ft) (hr). Brooks (20) established the correction factors, which make it possible to compare foreign records with United States records.

TABLE 1—SUNSHINE RECORD

City	Daily Amounts of Sunshine			
	Winter		Summer	
	Sunshine Hours	Percentage of Possible Sunshine Hours	Sunshine Hours	Percentage of Possible Sunshine Hours
Boston, Mass.	4.9	51	9.0	61
New York, N. Y.	5.5	56	9.7	67
Miami, Fla.	7.6	70	8.8	65
Chicago, Ill.	4.3	44	10.7	70
Los Angeles, Calif.	7.4	72	10.5	75
Seattle, Wash.	2.6	29	9.4	62

TABLE 2—SOLAR ENERGY RECORDED AT BLUE HILL

Data are based upon 4 years' graphical averages

Month	Btu per (sq ft) (day)		Ratio, Vertical/Horizontal
	Horizontal	Vertical	
January	584	1070	1.84
February	880	1250	1.42
March	1210	1250	1.04
April	1370	900	0.66
May	1750	700	0.40
June	1890	710	0.38
July	1870	780	0.42
August	1790	860	0.48
September	1340	1100	0.83
October	1100	1210	1.10
November	630	980	1.55
December	502	960	1.90

(2) Percentage of possible sunshine. The total number of hours from sunrise to sunset give the number of hours when sunshine were possible if clouds would not interfere.

The actually observed hours of sunshine can be expressed as the percentage of the maximum possible. Maps of this type as well as maps showing the number of sunshine hours for each month, as a 50-year average, may be obtained from the U. S. Weather Bureau.

To illustrate the various sunshine records with definite examples, the records of several cities are compared in Table 1.

(3) Solar energy received on a horizontal surface. Under the direction of I. F. Hand (21) the Weather Bureau records the exact amount of solar energy falling, or incident, on a horizontal surface at some 20 stations. The instrument used is the pyrheliometer and the records are automatically traced on a recording instrument. The *Monthly Weather Review* tabulates the exact amount of sunshine for each day of each month for the different stations. The records are expressed in calories per square centimeter per day and can be converted into Btu per square foot per day, by multiplying them by 3.69. Recently several new stations have been opened.

(4) Solar energy received on a south-facing vertical surface. These records have been observed since 1945 by I. F. Hand at the Blue Hill Observatory (10 miles south of Boston, Mass.). From the point of view of house heating, the amount of solar energy reaching a south-facing vertical wall is most important, because the vertical surface receives more solar energy during the winter than does a horizontal surface of the same area. The comparison has been reported by I. F. Hand (22) ((23). During December-January, on clear days, nearly twice as much solar energy is received on a vertical surface than on a horizontal surface. During the spring and fall there is not much difference, while during the summer, the sun being high in the sky, more sunshine reaches the horizontal surface. The amount of solar energy for each month has been cal-

TABLE 3—NUMBER OF SUNNY AND CLOUDY DAYS IN DECEMBER

Days	4 Years' Vertical Data	15 Years' Horizontal Data	Per Cent of Monthly Total (Approximate)
	Number of Days		
(A) Dark	10	10	5
(B) Partly cloudy	5	6	15
(C) Above average	16	15	80

culated from Hand's results and is expressed in engineering units, Btu per (sq ft) (day).

Observations made at Blue Hill reveal that the amount of winter sunshine reaching a vertical wall is increased by reflection from snow on the ground, which is, of course, included in the records.

Calculations have been made to convert the horizontal incidence data, to predict the amount of solar energy receivable on south-facing tilted and vertical surfaces. The cosine law is used in such calculations, but it is applicable only to the direct solar radiation and not to the diffuse part. For exact data, actual measurements have to be made, which are more reliable than voluminous calculations.

The vertical incidence data have been available only since 1945 and only for the single Blue Hill station. Four years are too short a time to establish averages, but the knowledge of the vertical/horizontal ratios increases the usefulness of the longer records available on a horizontal surface.

(5) Distribution of clear and cloudy days. It is unnecessary to recall that the weather is capricious and nothing can be done about it. All that can be done is to observe the records and derive statistics from them. From the point of view of solar house heating, the most important problem is the sequence of clear, partly cloudy and cloudy days, during the winter.

Use of Solar Statistics

To illustrate the use of available solar statistics, an analysis is given of the Blue Hill station's records. Amounts of solar energy incident on a south-facing vertical surface are shown in Table 3 for each day of December, during the past four years. Examining these records we can see some really dark days, when less than 10 Btu per (sq ft) (day) has been received, but in contrast to the dark days there were several clear days, when the amount of solar energy reached levels higher than 2,000 Btu per (sq ft) (day). From day to day, the amount of sunshine may change 200-fold. The average value for the four December months was 1,003 Btu per (sq ft) (day); the more probable graphical average is 960 Btu per (sq ft) (day).

To visualize the solar energy groupings, the dark days, are marked *A*. These days received less than 480 Btu per (sq ft) (day), or half of the probable average. The partly cloudy days, *B*, received 480 to 959 Btu per (sq ft) (day), and the balance of the days marked *C*, are the above-average, or clear days, with more than 960 Btu per (sq ft) (day). There were several two- and three-day periods of dark days, when probably none of the incident solar energy could be collected for house heating and the heat had to be drawn from the storage reservoir.

The horizontal incidence records have been available for the past 15 years for Blue Hill. For an analysis of these data, see Table 3.

An examination of the 15 Decembers on record shows that dark day sequences of two, three or even four days' duration are not unusual. The longest dark period observed in December lasted five days and was recorded only once in 15 years. The January distribution showed one six days' and one seven days' sequence, which appeared to be the longest dark day sequence on record.

On the sunny side of the statistics, the above-average, or clear day (C) sequences, are more numerous. During the past 15 Decembers, a sequence of five such days occurred eight times, one six-day, two seven-day and one eight-day sequence of clear days have been recorded.

How Much Heat Storage?

Variations during the December months were generally within 10% from the 15-year average and they were very seldom more than 20%. This would correspond to a surplus or deficit of three or six days' sunshine per month. The conclusion can be reached that in the vicinity of Boston, a solar heat storage system capable of storing 9 or 10 days' heat supply, should be sufficient. It is possible to calculate that a system capable of storing fewer days' heat requirement may be sufficient, by providing an auxiliarly booster (possibly with electrical heating). The booster may be needed only during adverse weather and only for a limited number of days during the heating season.

TABLE 4—SOLAR AND SKY RADIATION IN DECEMBER

Total solar and sky radiation received on a vertical south-facing surface at Blue Hill, Mass., Btu per (sq ft) (day)

	1945	1946	1947	1948	4-Year Average
Total for month	31125	25440	39245	28580	31100
Average for day	1005	820	1265	920	1003
Sum of A days	1480	1405	555	2080	1380
Sum of B days	3300	5360	4015	2915	3900
Sum of C days	26345	18675	34675	23595	25820
Number of Days in Group for Month					
Group A*	11	11	6	12	10
Group B*	5	7	5	4	5
Group C*	15	13	20	15	16
Per Cent of Month's Total Radiation					
Group A	5	5.5	1.5	7	4.5
Group B	10.5	21	10	10	12.5
Group C	84.5	73.5	88.5	83	83

*Days in *A* group received 0-479 Btu per (sq ft) (day); *B*, 480-959; *C*, 960 plus.

Such calculations involve economic factors, but they cannot be reliable without further tests under actual living conditions. The cost of the initial installation of the auxiliary heater, the cost of its maintenance during intermittent service conditions and the cost of the electricity that is consumed by the system must be considered.

Weather Bureau records are available giving the hourly distribution of solar energy. More sunshine will be received around noon than during the early morning, or late afternoon. An analysis was made of the Blue Hill south-facing vertical records. It appears that during December-January the amount of solar energy received before 8 a.m. and after 4 p.m. (solar time) is less than 3.2% of the total amount received during the entire day.

There will be a certain minimum amount of solar energy that cannot be collected at all. This amount may be tentatively set down at 30 Btu per (sq ft) (hr). During December-January only 4.3% of the total solar energy was less than this minimum value.

During the December-January period, about 15 days per month will be above-average, or clear days, in the vicinity of Boston. An analysis showed that about 80% of the monthly total solar energy is received during the clear days and most of this could be collected.

An estimate of the solar radiation during cloudless days has been published recently by Fritz (24) for the entire United States. The complex problem of the available solar energy for any geographical location should give the following facts: Amount of solar energy; sequences of dark and clear days; deviations from the expected average.

Sunshine – Heat Load Relation

The amount of heat required to maintain a building at comfortable temperature can be calculated according to standard practice. The heat load is proportional to the degree days, that is, the daily average temperature difference below 65F. Weather Bureau records and maps are available giving the degree days for every month at many stations.

The most important factor in solar house heating is an exact knowledge of the collectible solar energy and its relation to the heat load, both on a monthly distribution basis. The heat load is known for a large number of places, but the exact amount of solar energy received on a south-facing vertical surface is known only for a single station (Blue Hill). The amount of solar energy received on a horizontal surface is known at 20 stations, but they represent only scattered dots on the map.

Lacking adequate quantitative data of solar energy, comparision can be made only on the basis of the available sunshine hour records. Some 200 stations have such data collected during the past 50 years. It has been mentioned that the U. S. sunshine hour recorder responds to solar energy in excess of 82 Btu per (sq ft) (hr); hence, a correction factor is added to the instrument readings. Records of the sunshine hours, therefore, indicate solar energy above a certain level which may approach the minimum value that can be collected.

Even if these data are at best only approximate, it is interesting to compare the Weather Bureau records (25) of sunshine hours with the degree days.

Fig. 1. Degree days per sunshine hours based on December and January data. The larger the number, as shown on this map, the more elaborate is the heating system required.

The ratio of degree day D and sunshine-hour S or D/S for December and January are plotted in Fig. 1. The ratio contours, drawn to connect places of about equal ratios, represent the number of degree days which would have to be compensated by one hour of sunshine. Some latitude was taken in drawing these lines in the Rocky Mountain and western areas. A high ratio indicates the need for a larger or more elaborate solar heating system. In the south, the line runs somewhat parallel to the latitude, while further north the lines dip down at the Great Lakes and curve upward near the sea coast. The line 8.0 represents ratios similar to those that exist just north of Boston.

The map represents only an attempt to visualize the geographic limits of the possibility of solar house heating and the lines should not be regarded as exact demarcation limits.

Efficiency of Solar Heat Collection

The solar heat collector is a device which absorbs the radiant energy of the sun and transforms it into heat which is delivered into the house or into a storage reservoir. The collector should be designed in such a way, that it should gather the greatest amount of winter sunshine. It should not become overheated by the unavoidable summer sunshine.

The amount of heat collected can be expressed as a percentage of the total incident solar energy, this figure being the efficiency of collection. It is desirable that the collection efficiency should be high during the winter, but low during the summer. At the same time it is equally desirable that the cost of the collector should be low.

The essential parts of a collector are:

(1) Black plate to absorb solar radiation.
(2) One or more air-spaced glass panes, transmitting solar radiation and acting as heat traps to diminish the loss of heat outward.
(3) Means for circulating heat from the black collector plate to the rooms or to storage.
(4) Insulation, preventing the loss of heat from the backside of the black plate.

(1) Black collector plate. This plate should absorb the entire solar spectrum. Approximately half of the total solar radiation is in the visible range. Some of the ultraviolet and most of the visible and infrared rays are transmitted by good quality window glass. Most flat black paints absorb at least 95% of the solar radiation transmitted by glass; thus the visable, as well as the infrared and the small amount of ultraviolet radiation are all transformed by these means into heat.

There is a definite advantage in using a thin metal plate for the collector plate. It can be assembled easily at low cost, cannot crack under the effect of heat, and it should last indefinitely, if it is coated with protective paints.

(2) Air-spaced glass panes. One or more air-spaced glass panes are required, to diminish the outward heat losses from the collector plate. At least 8% of the incident solar energy is reflected and about 2% is absorbed by each glass pane. If the angle of incidence for solar energy is greater than 60°, the reflection losses increase rapidly. The transmission of glass, used in a south-facing vertical collector, will be the greatest around the noon hour, but it will be lower during the early morning and the late afternoon. Less solar energy will be transmitted through the vertical glass, when the altitude of the sun increases. It is expected that relatively little solar energy will be collected by a south-facing vertical collector during May, June, July and August, to the great advantage of this type of collector.

It is obvious that a tilted collector could be arranged at an optimum winter tilt (around 60°-70° for the vicinity of Boston) to collect somewhat more solar energy during the winter. This effect may be counteracted by heavy snow, accumulating on the tilted collector, while the vertical surface would remain clear and could even receive additional sunshine reflected from the snow on the ground. The tilted collector would definitely collect more solar energy during the spring and autumn, when the heat requirement is not very great; it will collect heat most generously during the summer to the detriment of overheating the collector.

(3) Means for circulating the heat. Various methods are available for circulating the heat from the black collector plate to the rooms or to storage. Pipes can be attached to the black metal plate, circulating a liquid to the heat reservoir. Or the black metal plate can form one side of an air duct, with fans circulating warm air to the heat storage. Which method is selected is governed by costs.

(4) Insulating the backside of the collector. The collector may be placed at various locations in relation to the house, but its backside must always be insulated, to prevent heat losses from it. A panel type insulation, using low cost materials, is sufficient to attain a heat loss factor, U, of 0.1 to 0.15.

In a previous article, (6) calculations were presented for average winter conditions for the vicinity of Boston, where 1,000 Btu per (sq ft) (day) is the average amount of solar energy and 1,500 Btu per (sq ft) (day) is a mean value for the better than average days, as received on a south-facing vertical surface.

In Fig. 2, calculated efficiencies are shown for various hourly amounts of solar energy, and related to the temperature difference between collector plate and the outdoor air. These data can be used for any location, if the hourly values of solar energy and the daytime outdoor temperature are known.

The calculated efficiency of Fig. 2 is based upon a collector with two air-spaced glass panes ($U = 0.55$, if the temperature is below 100F). The backside of the collector is insulated ($U = 0.15$). The overall loss factor is therefore $U = 0.70$, when the collector temperature is below 100F. At higher collector temperatures, the overall loss factor increases and this has been considered in Fig. 2.

It is evident that the collection efficiency diminishes rapidly at increasing temperature differences. Assuming a winter outdoor temperature of 30F, and a collector temperature of 120F, the temperature difference will be 90F. At this level the collection efficiency

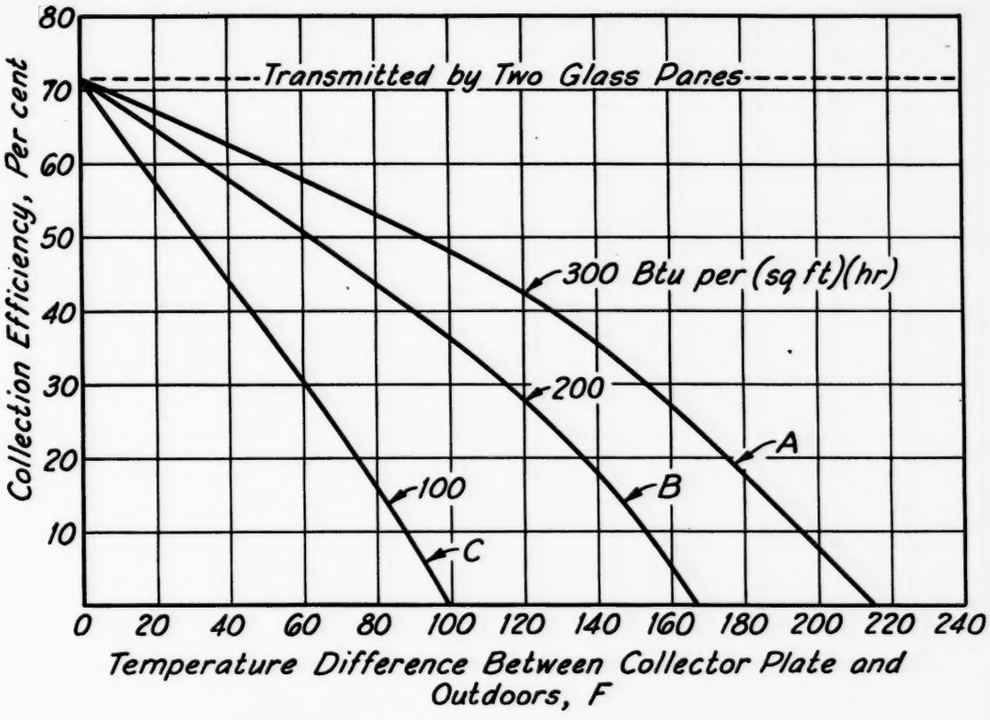


Fig. 2. Calculated efficiency of solar energy collector. Calculations are based upon a collector with two glass panes and an overall U of 0.7 and larger. Weather conditions for A, clear between 10 a.m. and 2 p.m.; B, slight haze or few clouds between 10 a.m. and 2 p.m.; C, partly cloudy or overcast—clear early morning or late afternoon.

will be 38 to 49% for the higher solar intensities, while only 8% will be collected when the amount of solar energy is 100 Btu per (sq ft) (hr).

It is obvious, therefore, that high collection efficiencies can be attained only on clear days or slightly cloudy days, unless the energy is collected at a relatively low temperature difference. On partly cloudy days collection would still be possible at a temperature of 110F, while nothing could be collected, during the winter, on such days at 130F.

Collector Temperature

The collected solar heat cannot be transferred to the heat storage reservoir unless a temperature difference is maintained. For this reason the storage temperature should be at a relatively lower level, probably around 100F, otherwise the early morning and late afternoon winter sunshine and the partly cloudy days sunshine could not be collected.

With the specific heat type heat storage material (water for instance) a daily cycle may be contemplated, starting in the morning with the temperature of the water at 85F. During a clear winter day, collection will be quite efficient during the morning and around the noon hour, but as the temperature of the water increases above 115F, and as the amount of solar energy decreases during the afternoon, it is probable that no additional energy can be collected during the later part of the afternoon.

Therefore high collection efficiency can be attained only if the temperature of the heat storage is at a relatively low level, probably 90-100F.

Temperature of the collector can be controlled by the flow of air, or water, adjacent to the collector plate.

TABLE 5—CHEMICALS FOR HEAT STORAGE

Chemical compound	Melting Point, F	Heat of Fusion, Btu per lb	Cost, Dollars per Ton
$CaCl_2 \cdot 6H_2O$	84-102	75	13
$Na_2CO_3 \cdot 10H_2O$	90-97	115	24
$Na_2HPO_4 \cdot 12H_2O$	97-118	114	70*
$Ca(NO_3)_2 \cdot 4H_2O$	104-108	90	*
$Na_2SO_4 \cdot 10H_2O$	88-90	104	9
$Na_2S_2O_3 \cdot 5H_2O$	120-126	90	58*

*Cost not certain.

Heat of Fusion Type Heat Storage

Requirements for heat of fusion compounds are low cost and availability. The low cost limits the choice to sodium, calcium, magnesium and possibly iron compounds which are generally available.

For house heating purposes the melting point of the chemical compound, or mixture, should preferably be in the 90 to 100F range.

Some of the materials which meet these requirements are given in Table 5.

There are many other materials or mixtures of different materials, which may show further advantages.

It should not be imagined that these chemical compounds could be packed haphazardly into containers, cans, tubes or tanks of any size and shape. If the proper conditions are disregarded, the chemical compound may not perform any better than a specific heat type heat storage material. The following important five factors must be considered.

(1) Undercooling. Most materials, melted in a closed container, without any stirring, will undercool below their melting points without any solidification. The presence of "seed" crystals, providing crystallization nuclei, promotes the process of crystallization. In closed, sealed containers it would be impossible to seed the chemical compounds from the outside and therefore crystallization nuclei must be provided, being in suspension in the material. Each material re-

quires a special additional agent to prevent undercooling and promote crystallization.

(2) Temperature stratification or segregation. During melting, the solid material being heavier, sinks in the liquid. Ice is an exception. The molten top layer may become warmer than the unmelted solid and therefore heat must be delivered in such a way that it should reach the unmelted material first. Temperature stratification is encountered frequently and various means have been suggested to lessen its effect. In the heat of fusion method, the heat must be delivered in such a way that the temperature currents should produce a certain amount of mixing.

Stirring or rotating the container by some simple and inexpensive method would of course eliminate the difficulty of undercooling and the temperature segregation.

(3) Corrosion. Most chemical compounds are more or less corrosive to metal containers. In a closed system, a small amount of corrosion inhibitor can stop the corrosive action.

(4) Volume changes. Most materials listed show very little change in volume on melting and solidifying. Metal containers withstand the slight volume changes, but glass or ceramic containers may crack, unless properly designed.

(5) Possible improvements. The heat of fusion type solar heat storage requires further development. The design of low cost containers, simple filling methods similar to mass-production canning operations, should produce standard heat storage units which can be manufactured and assembled at low cost.

The heat of fusion of the listed materials is around 75 to 115 Btu per lb and it is not expected that any suitable, low cost material could be found which has a considerably greater heat of fusion. The density of the listed materials is 90 to 110 lb per cu ft. The heat storage ability on a volume basis is around 10,000 Btu per cu ft.

Merits of Heat of Fusion

Below and above their melting points, the chemical compounds are capable of storing heat as the specific heat, which is very nearly the same as the specific heat of water, when compared on an equal volume basis.

The advantage of heat of fusion type materials is therefore:

(1) Heat storage as the heat of fusion, which is around 10,000 Btu per lb at the melting point, generally within a rather narrow temperature range.

(2) Higher solar heat collection efficiency due to the relatively low, nearly constant, storage temperature.

(3) Additional heat storage as specific heat, which is about the same as that of water on an equal volume basis.

It is estimated that about five to nine times more solar heat can be stored as the heat of fusion, than can be in water or any other specific heat storage material, compared on an equal volume basis.

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SIZING EXHAUST MAINS AT BRANCH JUNCTIONS

In layouts for duct systems for grinding, polishing and buffing operations, refuse removal in woodworking plants, and similar applications, it is usual practice to make the branches connecting to the hoods the same size as the throat openings at the hood connections, and to size the main duct so that its area at any point is between 20 to 25% greater than the sum of the areas of the hood connections between the point in question and the start of the duct system.

Some of the reasons for the oversize mains are: to reduce the friction loss in the main, improve the air balance of the system, and also provide additional carrying capacity in the main so that some additional machines may be connected at a later date without seriously upsetting the performance of the exhaust system. With oversize mains usually a reasonable number of added connections can be accommodated by a moderate increase in fan speed and horsepower.

Also some state industrial codes governing the installation of exhaust systems for grinding, polishing and buffing wheel exhaust systems require oversize mains, as for instance the New York State code which requires a 20% increase in mains for grinding, polishing, and buffing exhaust systems.

When branches are the same area as the hood connections, the diameter of the main duct at each point where branches are joined to it is determined by adding the areas of all the entering branches from the start of the system to the point in question, and then adding 20 to 25% to determine the area of the main duct at the given point. With the area of the main duct determined, it is then necessary to obtain the corresponding diameter taking the nearest whole inch dimension.

To simplify such calculations the chart on the back of this sheet has been designed by F. A. Stanton and H. M. Nichols of the Industrial Dept., Sturtevant Division, Westinghouse Electric Corporation. Results can be read directly from the chart without the aid of mathematical computations.

On the chart the bottom scale represents the diameter of the main up to the point of entrance of the branch. The two vertical scales represent diameter of entering branch for two conditions, one where it is desired to make the main 20% oversize and the other where it is desired to make the main 25% oversize. The curved lines on the chart represent the proper diameter of the main duct to accommodate the added branch connection.

The chart is used by following along the horizontal and vertical scales until they intersect, and at that point determining the nearest reading *on the circular lines* which represent the diameter of the increased main.

As an illustration, assume a 5-inch branch at the start of the exhaust system. In this case the previous main is zero. Read up from the zero line on the horizontal scale to the intersection of the 5-inch line on the vertical scale and, using the plus 25 vertical scale, read 6 inches (nearest whole inch size) diameter on the circular scale for the diameter of main.

Now assume that the next branch connection is 8 inches in diameter. Read up from the established main diameter of 6 inches to the intersection of the 8-inch vertical scale and find a main diameter of 11 inches.

This process is continued until the entire main is sized without the necessity of any mathematical calculations.

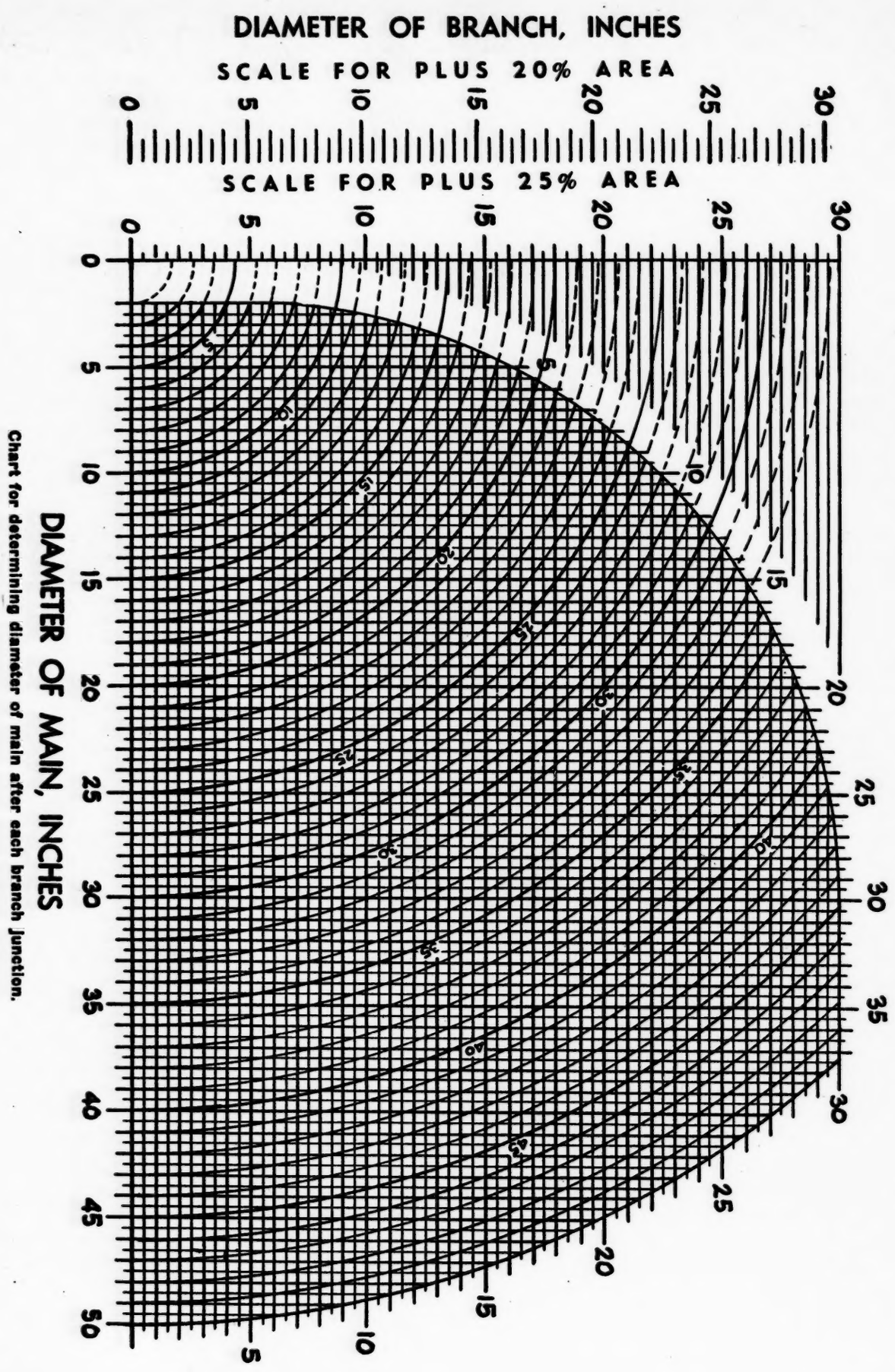


Chart for determining diameter of main after each branch junction.

HEATING AND VENTILATING'S REFERENCE DATA

September, 1949

Domestic Heating Studies in Britain

CYRIL TASKER

Several months ago some of the studies being made in England to develop practical data to aid in improving heating systems for British homes were reviewed in these columns. It was noted that the experiments were planned on a long-term basis, and it was suggested that future results should be of interest. Additional significant and interesting results have recently been published in British technical journals.[1] Since two of the three papers already published appear in journals not generally available in America, it has been suggested that a relatively brief summary might be of interest to those concerned with house heating in America, even though British house construction methods differ from American, and much of the equipment used in the British tests differs considerably in size, and to some extent in design, from that used in this country.

VERY little information was available in England, prior to the end of the war, on the relative economy and amenity of the various methods of providing space heating, hot water and cooking facilities for houses of around 1000 sq ft floor area. The Egerton Committee, whose report, as mentioned in the previous review, was used by the Government in formulating policies on housing and fuel utilization, strongly recommended that steps be taken to collect authoritative statistical data on various combinations of appliances and suggested that such studies would "provide a correlation between the general experience of users of fuel and calculations based on laboratory work on appliances." It was recognized that while some of the factors that govern the choice of a heating system could be stated quantitatively, others, such as personal tastes, could not be measured, and yet they played an important part in the final choice.

The Government therefore authorized an exhaustive series of full-scale tests to be carried out by the Building Research Station, which is located near London and is operated under the Department of Scientific and Industrial Research. Results now becoming available merit careful study, for it is perhaps no exaggeration to say that the studies constitute the largest scientifically controlled house heating experiment under way in the world today.

At the present time 32 houses are being used in this experiment. Eight detached houses, with almost identical heating systems but with different degrees of thermal insulation, were described and illustrated in the previous review, which gave the results of tests in both the unoccupied and occupied stages.

Ten pairs of semi-detached houses, twenty houses in all with nineteen different heating systems, were the next to be built on an experimental building site at Abbots Langley, some two miles from the Building Research Station (see Fig. 1). They were designed so that all the houses had as nearly as possible an identical degree of thermal insulation. There are two plans as shown in Fig. 2, both have three bedrooms, two large and one small, and a bathroom upstairs. One system was repeated in two houses in order to assess the difference between the northern and southern house in a semi-detached pair. It is with these houses that the present review will mainly deal.

Recently a terrace of four houses, built on the open-plan and more nearly resembling typical American small houses, has been completed. These houses are heated by a warm air system which is a British adaptation of an American development.

The twenty semi-detached houses were divided into three groups in which the space heating systems were intended to provide "partial," "two-stage," and "whole house" heating, respectively. There are eight houses in the "partial" group. The living rooms are heated by some version of the open fire or stove; the kitchens are unheated except for incidental heat from the cookers or the domestic hot water heaters; the halls, bedrooms and bathrooms are unheated.

In the eight houses in the "two-stage" group, the whole house is supplied with "background heating" to about 50F, usually by convected warm air. Gas or electric radiant fires are used to "top-up" the rooms to about 65F during periods of occupancy. One house has electric tubular heaters for background heating, electric radiant fires for topping up and electric convectors in the bedrooms.

Fig. 1. Abbots Langley houses and weather station.

[1]The three papers in question are "Economics of House Heating" by Richard Eve and J. C. Weston, published in the Journal of the Royal Institute of British Architects, November 1948; "Post War Research in Heating and Ventilation at the Building Research Station" presented by A. T. Pickles before the Institution of Heating and Ventilating Engineers in London on March 2, 1948 and to be printed in the Journal of the Institution, and "The Efficiency of House Heating" by J. C. Weston, Journal of the Institute of Fuel, Vol. XXII., No. 124, February 1949.

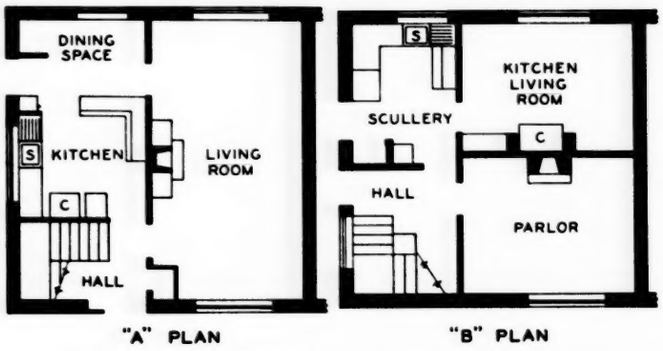


Fig. 2. Alternate floor plans of experimental houses.

The other four houses have central heating, more or less as we understand it in this country. The boilers are magazine-fed and burn sized anthracite. Two houses have radiators under the windows, one has radiators along or near the spine wall (an interior load-bearing partition which supports the joists of the floor above) and one has a panel heating system in which convected warm air heats a part of the first floor and most of the second floor. Complete details of every house and its heating system are given in the first and the last papers reviewed. It should be noted that *all* flues are on inside walls. In most cases the customary brick flue was replaced by a metal flue with a breeze block shroud, provided at intervals with sheet-metal inspection doors.

The importance of these studies in England's post-war building program lies in the fact that by far the great majority of the houses being built since the war by local authorities for rental purposes, as well as most of the pre-war houses built by private enterprise, are of this type and size, i.e., about 925 sq ft in area. There is every indication that a large proportion of the houses to be built in this country in the next few years will be of the small home type. To date not too much attention has been paid to the problem of providing adequate, efficient and economical heating systems for such houses.

Program of Tests

The experiment is divided into two periods. During the first—the unoccupied period—the houses were furnished and run to a regular routine for 15 hours each day by laboratory staff. This routine was made as far as possible typical of the life of a family of four, two adults and two children. The tests lasted from late September 1947 through March 1948.

In the second period the houses are rented, unfurnished, to tenants who, as part of their tenancy, agree to cooperate with the staff of the Building Research Station in securing essential data. However, to enable the tenants to lead normal lives without interruption by observers taking measurements, resistance thermometers were installed and all temperatures are automatically recorded at a central station. The correct functioning of the various appliances is checked, and in addition to measurements of air movement and ventilation, which will be discussed more fully later, measurements are made of the discoloration of surfaces due to appliances and even of acoustic transmission through the heating ducts. Data are collected on the amount of hot water drawn off (to do this a special Btu meter was developed) and on the amount of fuel used in each appliance.

The tests in the occupied houses are still under way and will continue for some time. A vast amount of data are being collected; to aid in the analysis the results are punched on cards and modern statistical methods used to assess the significance of each of the main factors. A complete meteorological station on the site makes possible the study of the effect of weather conditions on heat losses, heating costs, etc.

Value of Thermal Insulation

The degree of insulation of these twenty basementless houses can be judged by the fact that the walls have a *U* value of 0.20, the roofs, insulated by 1 inch of loose slag wool, have a *U* value of 0.17 and the ground floor, depending on whether it has a tile finish or a wood finish, a *U* value of 0.20 or 0.15.

It soon became apparent, from data collected in the unoccupied period, that the houses did not cool down as much overnight as had been expected. This was true even when overnight burning appliances were banked or open fires tended for the last time and allowed to go out. It is difficult to translate the results obtained in these British experiments to comparable

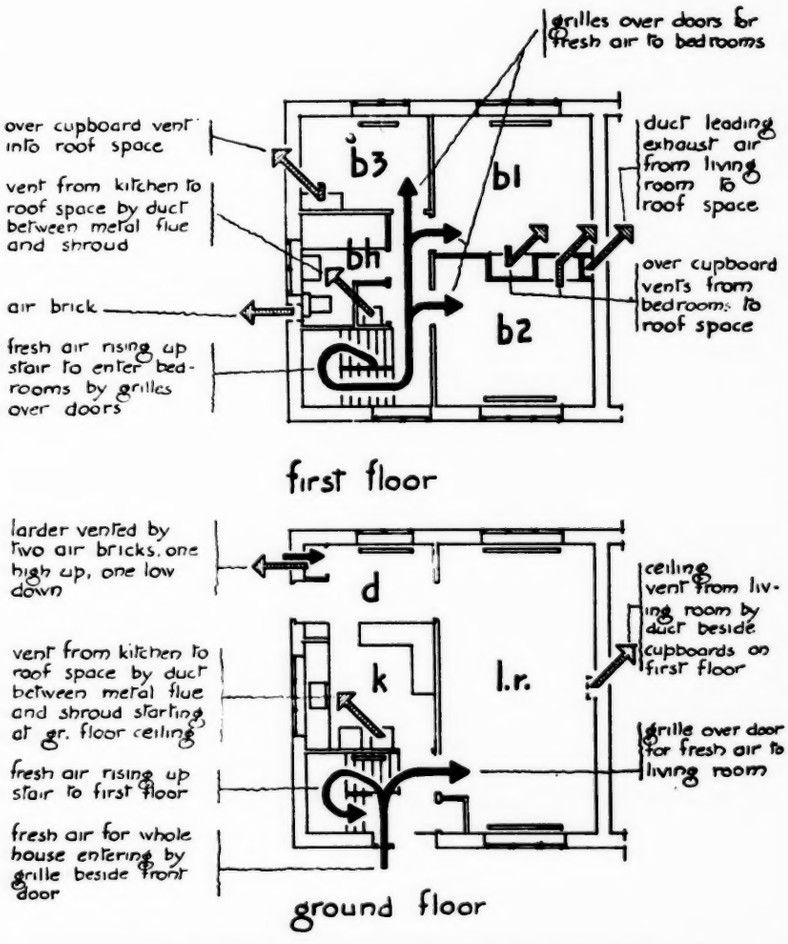

grilles over doors for fresh air to bedrooms
over cupboard vent into roof space
vent from kitchen to roof space by duct between metal flue and shroud
air brick
fresh air rising up stair to enter bedrooms by grilles over doors
b3
b1
bh
b2
duct leading exhaust air from living room to roof space
over cupboard vents from bedrooms to roof space
first floor
larder vented by two air bricks, one high up, one low down
vent from kitchen to roof space by duct between metal flue and shroud starting at gr. floor ceiling
fresh air rising up stair to first floor
fresh air for whole house entering by grille beside front door
d
k
l.r.
ceiling vent from living room by duct beside cupboards on first floor
grille over door for fresh air to living room
ground floor

Fig. 3. Principles of house ventilation system.

results in small houses in America, because of differences in construction methods, heating systems and habits, and climatic conditions. However, the flywheel effect, observed where building construction is such that the outer elements have low heat transmission properties or high thermal storage properties, was illustrated in the results from these tests. The tests to date have served to illustrate that improved insulation applied to British houses can effect substantial savings and improve comfort conditions.

Natural Ventilation

Based on studies by Yaglou and others, the Egerton Committee recommended minimum standards of ventilation, based on the necessity of keeping occupied spaces free from noticeable odors, of 10 cfm per person. This gives typical ventilation rates as follows:

Living room	4 persons	40 cfm
Bedroom	2 persons	20 cfm
Bedroom	1 person	10 cfm
Kitchen		1 air change
Halls, passages, bathroom and W.C.		2 air changes or more

Because they felt that there was little information available on typical rates of ventilation in dwellings, the Committee suggested that these recommendations be considered as tentative only.

Mr. Pickles says that a program of ventilation research was set in action at the Building Research Station because it became evident that a large amount of statistical information on typical rates of air change would prove necessary in conjunction with the program of full-scale researches on houses. The technique adopted was that of using a tracer gas (helium) with a Katharometer as detector. The Katharometer is essentially a Wheatstone bridge circuit by which differences in the thermal conductivity of gases can be determined. The principle is well known and has been widely adopted. Minute changes in gas composition can be accurately and continuously measured.

The ventilation system in these houses is not orthodox, and the general principles are given in Fig. 3, which relates to a centrally heated house, in which there is a solid fuel flue in the kitchen. There are modified systems in the two other main groups of houses, which are those with a solid fuel flue in the living rooms, and those with solid fuel flues in both kitchen and living room. Systematic measurements were made in three houses, in which the ventilation systems were, respectively, typical of the centrally heated house, and the two modifications described above. The measurements were carried out in close relation to observations of the external wind velocity, and it was found that the ventilation rate could be expressed as a constant term plus a term increasing linearly with wind velocity (approximately 0.1 air change per hour for each 1 mph in wind speed).

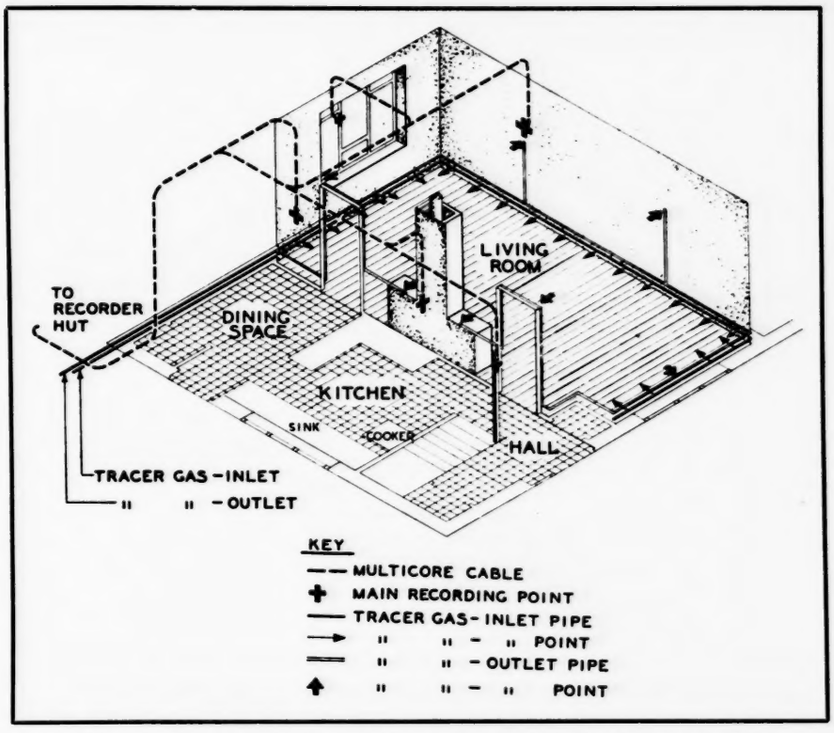


Fig. 4. Instrumentation and tracer gas piping at Abbots Langley.

From a statistical examination of the results, mean rates of ventilation in the various rooms of the houses during the winter were calculated, and it was found that the ventilation rates actually observed are in excess of the minima recommended by the Egerton Committee by amounts ranging from 1 to 2 air changes per hour. These measurements were carried out in unoccupied houses, in which the internal doors and the windows were kept shut, and under tenanted conditions greater rates will be observed, due to doors being left open and, more important, windows being opened.

It is evident that control of ventilation rates will be necessary as part of the general campaign for more efficient heating of houses. For this, further work on standards of ventilation is required and also observations during occupied conditions. These latter are now being carried out in the experimental houses by means of a copper tube system (Fig. 4) which enables helium to be introduced into each room, and the composition of the air to be sampled during the subsequent decay, the whole operation being carried out from outside the house without disturbing the occupants. All doors were fitted with metal weather stripping. For the occupied phase arrangements were made to record automatically, at the remote station, the number of times the doors and windows were opened and how long they remained opened.

The work on the natural ventilation of houses is novel in scale and conception. Arrangements are being made for the preparation of a comprehensive report to appear during the course of the year.

The third paper deals mainly with estimates of the annual heat requirements of houses with a variety of heating systems, based on data developed in the un-

occupied phase of the over-all study. The routine conditions to which the houses were run during this period would hardly be considered "comfort heating" by most American householders but they certainly are a big improvement over conditions experienced in the majority of British homes in pre-war days. Routine temperatures for living rooms were: 45 to 50F from 10 p.m. to 7:30 a.m.; 55F from 7:30 a.m. to 2:00 p.m. and 65F from 2:00 p.m. to 10:00 p.m. Bedrooms were generally required to be at 50F except for two periods, of 1 hour each, every day, when they were "topped-up" to 55F.

From the data collected, estimates were made of the *annual* consumption of each system for an average year. The average weekly fuel requirements for water heating were added to the weekly fuel consumption for space heating. The "whole-house" group of houses occupies a satisfactory position when the house mean temperatures are taken into account.

In system efficiency calculations, the heat produced by all the appliances in each house is divided by the thermal input to each house for an average heating season. Here, again, the "two-stage" and "whole-house" systems proved of higher efficiency than the "partial" system. It should be remembered that these efficiencies are based on the unoccupied phase when the appliances were run by laboratory staff, and doors and windows were kept shut. Dr. Weston points out that the results for the system efficiency were somewhat better than would be expected from the test-bench efficiencies of the appliances. The main reason for this, he suggests, is that part of the flue losses are recovered as heat gains from the flue, only the heat passing up the flue at the level of the second-floor ceiling being lost.

Domestic Heating Load

The last section of Dr. Weston's paper is concerned with the magnitude of the individual load for space heating and water heating and its importance in connection with district heating schemes. He shows that for insulated centrally heated houses with hot water radiators under the windows, the total load is likely to be at least 20% higher than the maximum figure hitherto assumed in planning possible district heating systems for houses in the southern parts of England. The chief reason for this, he says, is that with well-insulated houses the house temperatures overnight are higher than assumed.

Laboratory Studies and Full-Scale Experiments

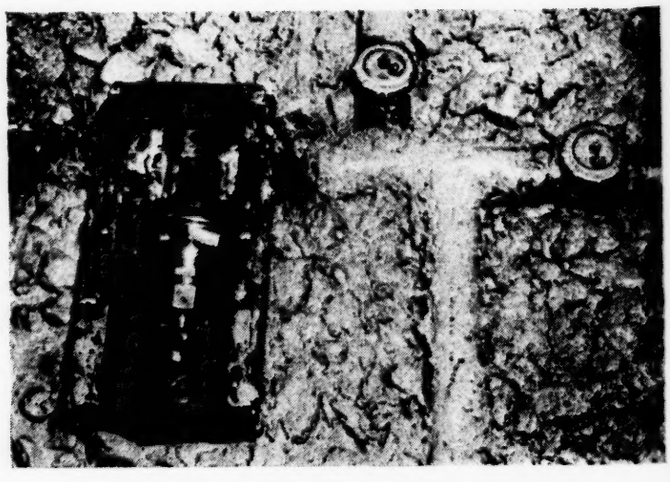
"There is a large gap," Mr. Pickles pointed out in his paper before the Institution of Heating and Ventilating Engineers, "between the laboratory and the everyday practice of an industry, yet it is only by the precision that is possible in the laboratory that firm conclusions may be reached on which practice can be based. The provision of special laboratories, such as the wall, roof, flue and heating laboratories of the Building Research Station, represents a considerable extension of facilities capable of giving more directly applicable results. The next stage, and the essential link between the specialized laboratories and practice, is instanced by the large scale experiments which are being carried out by the Station; the experimental houses are both laboratories in which detailed thermal measurements are made and at the same time houses in which ordinary people live. They resemble the pilot plants in the chemical industry, in which experiments previously made in test tubes and beakers, are carried out on a works scale in order to assess the possibilities of quantity production."

Mr. Pickles' review also covers recent work at the Building Research Station on heat transmission through building materials, in the wall and roof laboratories, and physiological studies in the heating laboratory, with brief mention of the work on air filtration and on flues or chimneys. It shows to what extent the Building Research Station, operated by the Government, has become one of the most important centers of research for the heating and ventilating industry in Britain.

Figures 1, 3, and 4 are reproduced by courtesy of the Institution of Heating and Ventilating Engineers.

Radiant Panel Balance Control

Balance control valves for a floor radiant heating system at the new Greenville, S. C., County Home are shown at right before the concrete slab was poured. A main control valve in a metal box also is shown. Two "Radiantrol" valves, products of The Homestead Valve Manufacturing Co., Coraopolis, Pa., serve to balance the system and act as air vents. Similar to ordinary butterfly valves, the Homestead units are welded into the wrought iron radiant heating pipe. A brass stem extends from the valve to a brass floor plate that is flush with the finished floor and operated by foot to regulate the system. The balancing valves control water flow into individual room coil panels and can be set to distribute flow in any proportion desired for comfort in various parts of the house.



Effect of Thermostat Characteristics on Panel Heating Performance

PART 2

R. J. LORENZI* and L. P. HERRINGTON*
John B. Pierce Foundation, New Haven, Conn.

In Part 1 of this 2-part article, the authors presented a background discussion of radiant and convective components of comfort. Tests at the John B. Pierce Foundation Laboratory of Hygiene were reported, showing differences in performance of an electric panel heating system controlled by a modular and by an on-off thermostat. In Part 2, the authors show how characteristics of the on-off thermostat, with respect to enclosure form, finish, and location, affect performance of the system.

GROUP 3 of the thermostat tests was a series of experiments designed to determine the effect of cover design and finish on thermostat operation and room thermal conditions. Eight tests, each consisting of from one to eight phases, were performed, and seven cover variations were utilized. All tests were performed with the same thermostat mechanism (the on-off type described in Group 1), but with cover variations as follows:

No. 1. A highly polished aluminum cover containing a multitude of perforations, and having an emissivity estimated to be about 0.10, thus making the the thermostat in this cover very sensitive to convection and almost unresponsive to radiation.

No. 2. The standard cover supplied with the thermostat and finished with a transparent oxide plating producing a lustrous to polished champagne tone. Perforations were the same as No. 1 cover.

No. 3. A bronze tone finish of intermediate emissivity. Perforations as above.

No. 4. A semi-glossy black finish, with perforations restricted to a few small openings in the front.

No. 5. The standard or No. 2 cover painted with flat black paint.

No. 6. The "Pierce Black"—a black body type of cover finished with matt black paint and containing no perforations. Emissivity was about 0.95, thus making the thermostat with this cover very responsive to radiation. A hemispherical form was incorporated at the lower front section of this cover in order to increase the radiation sensitivity and to concentrate its effect on the thermostatic element.

No. 7. "Pierce Modified"—same form as No. 6 but with only the hemispherical button painted black, the remaining surface being polished.

Covers 1-6 are illustrated in Fig. 2. All covers were constructed of aluminum of thickness .015 to .020 inch, and Nos. 2, 3, and 4 were commercially available.

First under the group 3 heading may be considered four experiments, all of which were performed under almost identical conditions (70F thermostat setting, 1 degree total thermostat differential, two exterior environments for each test, 20F and 45F, and ceiling input of 1,800 watts). Pertinent data for these four

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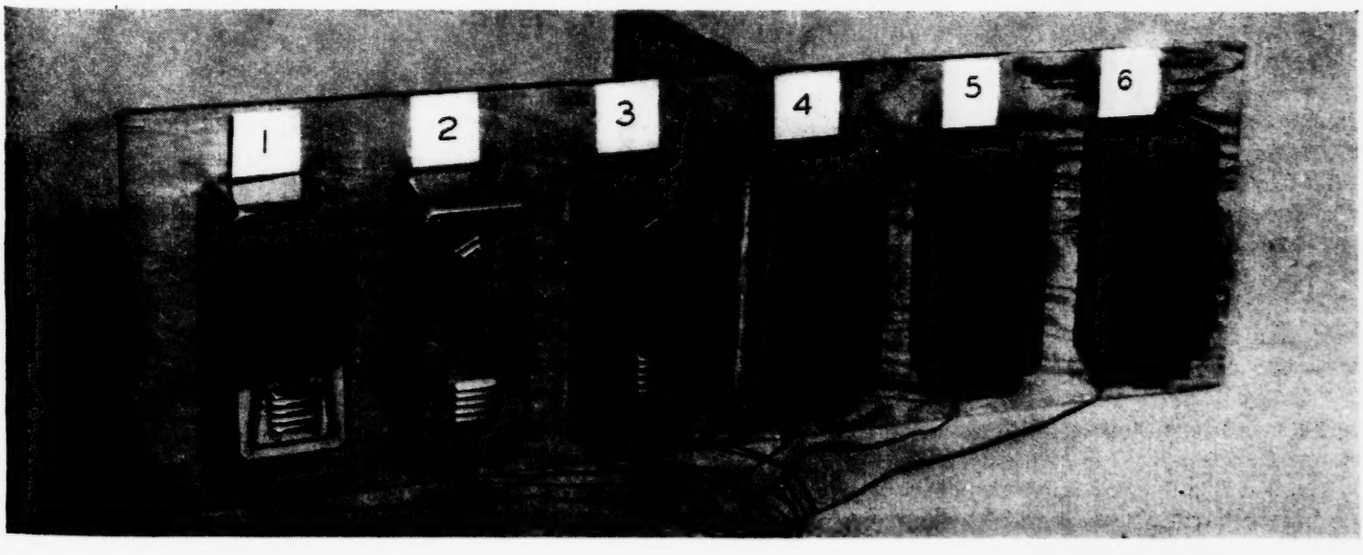


Fig. 2. Thermostat covers 1 to 6 used to determine effect of enclosure on system performance.

TABLE 2.—DATA FOR TESTS OF FOUR THERMOSTAT COVERS

(Conditions of tests: 70F thermostat setting; 1 degree total thermostat differential; 1,800 watts ceiling input)

Item	Cover No. and Type			
	No. 2 Standard	No. 3 Bronze	No. 4 Semi-glossy Black	No. 6 Pierce Black
With 20F Shell Spaces				
Average temperature lower surface of ceiling, F	91.3	89.3	87.3	91.4
Maximum-minimum differential—ceiling surface, F	9.5	9.5	7.5	7.0
Average temperature 48-inch globe, F	69.3	69.2	68.1	67.9
Maximum-minimum differential—48-inch globe temperature, F	1.0	1.5	1.0	1.5
Average temperature 48-inch air, F	67.2	67.4	66.2	66.1
Maximum-minimum differential—48-inch air temperature, F	0.5	1.0	0.5	0.5
Weighted inside-outside temperature differential, F	30.7	28.5	27.8	29.5
On-off cycle duration, minutes	47.3	41.8	38.4	36.0
With 45F Shell Spaces				
Average temperature lower surface of ceiling, F	79.6	77.7	78.1	80.0
Maximum-minimum differential—ceiling surface, F	7.5	10.5	8.0	9.5
Average temperature 48-inch globe, F	68.8	69.3	69.2	68.3
Maximum-minimum differential—48-inch globe temperature, F	1.0	1.0	0.5	1.5
Average temperature 48-inch air, F	67.6	68.4	68.1	67.4
Maximum-minimum differential—48-inch air temperature, F	1.0	1.0	1.0	1.0
Weighted inside-outside temperature differential, F	16.1	14.8	14.8	15.7
On-off cycle duration, minutes	36.0	40.3	35.1	32.0
Change in average globe temperature, F, after shift from 20F to 45F in exterior shell	—0.5	+0.1	+1.1	+0.4
Change in average air temperature, F, at 48-inch level after shift from 20F to 45F in exterior shell	+0.4	+1.0	+1.9	+1.3

tests are presented in Table 2 in which comparisons between covers may be made by reading across the table, and comparisons for each single cover operating with different loads may be made by reading down.

Significant in this table is the fact that the increase in emissivity and decrease in ventilation of covers 4 and 6 produced an appreciable reduction in the maximum-minimum temperature differences for the ceiling surface. Very large reductions in maximum-minimum swing were obtained when the thermostat differential was reduced. In addition, the black covers have produced still further reductions. However, in the latter case, the ceiling reductions did not result in further significant decreases in globe and air differentials.

Overall inside-outside temperature differentials weighted for both area and transmission coefficients are presented to show the variations in heating load for the different tests. For the 20F tests the maximum variation was 9.5%, and for the 45F tests it was 8%. The on-off cycle duration or the total cycling time is a function of load, installed capacity, thermostat differential, and cover design. Installed capacity and thermostat differential were constant in the four tests, and since the load variation was as stated above, at least half of a 24% reduction in cycling time for the 20F tests and a 20% reduction in cycling time for the 45F tests, may be attributed to cover design. For both external conditions the Pierce Black cover resulted in the shortest cycles.

The last two lines of Table 2 show the globe and air temperature variations with changing external load. For globe temperatures the No. 3 or bronze cover was most constant with a variation of only 0.1 degree, while for the air temperature the No. 2 or standard cover was most constant with a 0.4 degree variation. It was stated earlier that for equivalent comfort for all outdoor temperatures the thermostat should be capable of compensating for external load changes while maintaining a constant globe temperature. The bronze cover appears to produce this result, while the Pierce Black cover seems more favorable with respect to cycling time.

Secondly, under the group 3 heading may be considered a test consisting of eight phases, four of which were performed with 10F exterior temperatures and four with 60F exterior temperatures. Test room thermostat setting was raised to 80F to obtain the greatest possible inside-outside differential, and covers 2, 3, 4, and 7, were used. The thermostat differential was increased to 1.5 degrees, since operation with the 1 degree differential was found to be erratic at the higher setting. Ceiling input was increased to 2,900 watts to compensate for the greater load. Data are presented in Table 3 and may be interpreted in the same manner as data for Table 2. In general, the maximum-minimum differentials are higher than those shown in Table 2, and this is due to the greater installed electrical capacity with its attendant higher ceiling temperatures, and to the higher thermostat differential. Operation with the bronze cover appears to have a slight advantage when judged on the basis of maximum-minimum differential.

Outside environment was very carefully controlled in all phases of this test, and the weighted inside-outside temperature differential indicate a maximum load variation of only 2.5% for the 10F condition, and

TABLE 3.—DATA FOR TESTS OF FOUR THERMOSTAT COVERS

(Conditions of tests: 80F thermostat setting; 1.5 degree total thermostat differential; 2,900 watts ceiling input)

Item	Cover No. and Type			
	No. 7 Pierce Modified	No. 4 Semi-glossy Black	No. 2 Standard	No. 3 Bronze
With 10F Shell Spaces				
Average temperature 48-inch globe, F	79.6	78.5	80.1	80.0
Maximum-minimum differential, 48-inch globe, F	3.0	3.0	2.0	2.0
Average temperature 48-inch air, F	77.1	76.0	77.6	77.5
Maximum-minimum differential, 48-inch air, F	3.0	2.0	2.0	2.0
Weighted inside-outside temperature differential, F	45.7	45.3	46.5	46.5
On-off cycle duration, minutes	80.7	68.8	66.0	64.6
With 60F Shell Spaces				
Average temperature 48-inch globe, F	80.0	79.5	79.8	80.0
Maximum-minimum differential, 48-inch globe, F	3.0	2.5	2.5	2.5
Average temperature 48-inch air, F	79.3	78.8	79.1	79.3
Maximum-minimum differential, 48-inch air, F	2.5	2.5	2.5	2.0
Weighted inside-outside temperature differential, F	15.3	16.0	15.9	15.8
On-off cycle duration, minutes	68.2	57.0	54.0	52.6
Change in average air temperature at 48-inch level after shift from 10F to 60F shell space condition	0.4	1.0	— 0.3	0.0
Change in average globe temperature after shift from 10F to 60F shell space condition	2.2	2.8	1.5	1.8

4.5% for the 60F condition. Corresponding reductions in cycling time were 18.5% for the 10F set, and 23% for the 60F set.

The effect of partially removing a radiant absorptive surface is clearly shown by the cycling time response of the Pierce modified cover. Restricting the blackened area to the hemispherical button alone (a reduction of 70-80% changed the Pierce cover from first to fourth rank in cycling time. The remaining covers differed only slightly in cycling time, with the bronze giving the best performance. With respect to constancy of globe temperature with extremes of outside temperature, the bronze cover was again most favorable, with the other covers having greater but reasonable variations.

Finally, under the group 3 heading, should be considered three check experiments using covers 1 through 6 without the thermostat mechanism. The room was controlled by the wall-mounted thermostat operating without a cover, and the six covers, mounted on a test board (Fig. 2), each contained a thermocouple by means of which readings were taken at 5-minute intervals during test periods. External environment was 20F. In the first of these experiments the test room was permitted to cool to 65F, the ceiling panels were then energized, and the room was allowed to warm up slowly while readings of temperatures in the covers were taken. The Pierce Black cover (No. 6) showed the fastest response, being 18% faster than the worst which was the polished (No. 1) cover.

The remaining two experiments were performed during normal on-off cycles, and the data indicated a reasonably constant difference between the temperatures in the covers, with the greatest differences (approximately 1.5 degrees) appearing between the polished and the Pierce Black covers. The lower temperature existed in the polished cover, and is probably close to a true air temperature, while the higher temperature in the black cover may be considered as an air-radiant temperature which is the temperature sensed by the human body. This one-and-a-half degree difference represents the amount of thermostat droop in this particular case, and will result in an apparent shift in control point when a thermostat is operated with a black cover. The amount of droop is a function of the mean radiant temperature, and the 1.5-degree figure applies only to the case under consideration. When a thermostat is operated with the polished cover, there should be no droop, and the temperature inside the cover as well as an average room air temperature should be 70F for that setting. However, when operating with the black cover, the temperature in the cover will be 70F, but the average air temperature will be lower by the amount of the droop. It is believed that this droop effect is the crux of energy savings obtained with black body cover operation, and is contingent upon the assumption that equivalent comfort can be obtained without having to reset the thermostat to a higher point to compensate for droop.

The latter two experiments confirmed the results of the first experiment with respect to response time, showing about a 20% faster response for the black cover for both rising and falling temperatures. This is, of course, responsible for the shorter cycling time when the black cover is used.

Group 4 – Cold Wall Location

Room thermostats are generally located on an interior wall, and it is believed that this is a habitual process which probably was started by the fact that

the interior wall location provides a thermostat mounting which will not cause the instrument to be affected by conduction from the wall, since an interior wall is almost always within a degree of the air temperature. This permitted the thermostat to be affected primarily by convection. However, since the human body is affected by radiation as well as convection, it seems reasonable that a thermostat should be responsive to both of these variables. This offers two possibilities: (1) permit the thermostat to remain on the inside wall and fit it with a cover which will be responsive to both radiation and convection in roughly the same ratio as the human body (considered in group 3), (2) relocate the thermostat to an outside wall where the effects of the surface temperature, which the body senses as radiation, will affect the thermostat by conduction. Actually, the temperature at the inside surface of the exterior wall is the integrated effect of outside air temperature, solar and sky radiation, wind movement, and wall structure, and of the inside air temperature and radiant sources. In addition, all outdoor changes are felt at the interior surfaces of an exterior wall before they affect the inside air. A thermostat thus located should, therefore, be sensitive to the same changes which the body senses.

This second possibility was the basis for the group 4 experiments which consisted of two tests performed with the on-off control used earlier but relocated to an outside wall. Setting was 70F, and exterior conditions were 20F and 45F with a ceiling input of 1,800 watts. Tests were performed with the standard and Pierce Black covers and may be compared with the earlier tests done with these covers with the thermostat in the warm wall location. When the "standard cover-warm wall" location was compared with the "standard cover-cold wall" location, it was found that for the latter condition, the average of all interior points (lower surface of ceiling and air 6 inches below ceiling excluded) was 2.8 degrees higher, and the maximum-minimum temperature differences were about the same. When the "black cover-warm wall" location was compared with the "black cover-cold wall" location, the interior points' average was found to be 3.5 degrees higher for the cold wall condition, and the maximum-minimum differences were again about the same. These results indicate that regardless of cover finish, the cold wall location causes a droop which necessitates a lower thermostat setting for equivalent comfort — a setting of approximately 67F in this instance. The extent of this droop effect is a function of the interior surface temperature of the wall, extent of contact of back of thermostat with the wall, internal construction of the thermostat, etc., and would, no doubt, have to be determined for each particular installation.

Group 5 – Transient Heating Load

In most of the experiments previously described, thermostat performance was observed under steady state heat transfer conditions. Since such conditions rarely occur in actual installations, two three-phase tests were planned to observe performance with a transient heating load. These tests were preceded by an equilibrium state in which the shell spaces were controlled at 60F and the room thermostat set at 80F. After equilibrium had been attained, the shell space temperatures were lowered at the rate of 5 degrees per hour until 10F was reached. The tests were then continued for several hours to make certain that the full effect of the 50-degree outside temperature drop had shown itself within the room. Analysis of the data indicated that with severe variation in external stress, a standard wall-mounted on-off thermostat of low mass, equipped with a radiation sensitive cover, provided excellent control of room temperature when used with the low heat capacity electric ceiling panels. This occurred despite the extremely low thermal capacity and average 0.26 Btu per (hr) (sq ft) (F) overall coefficient of heat transfer of the wall structure.

Proposed Thermostat Specifications

Results of the tests described make it possible to present a specification requirement for thermostats to be used in conjunction with electric ceiling panels of low thermal capacity.

(1) Simple on-off type thermostats may be used, provided the total operating differential does not exceed 1.0 to 1.5 degrees.

(2) Differential adjustment should be possible through direct mechanical means (or effective differential adjustment should be obtained by internal heating).

(3) The cover should have a high emissivity finish and a low ventilation rate so that it will be sensitive to radiation as well as convection, and produce short on-off cycles.

(4) To produce optimum comfort, the instrument should be capable of providing a constant (or nearly constant) air-radiant (globe) temperature at the room center when the heating load is varied.

In addition to the above requirements determined by test, the following general features should be included.

(5) Operation should be quiet.

(6) Thermal capacity of the instrument should be low to provide the feature of low thermal lag.

(7) Cost should be moderate in order to permit use of a separate thermostat for each room.

(8) The cover material should be of light gauge metal of high thermal conductivity (preferably aluminum).

Summary and Conclusions

(1) Basic air-radiant temperature relationships affecting thermostat requirements and performance have been presented.

(2) Criteria for judging control performance have been considered.

(3) A description has been given of several groups of experiments, the main purpose of which was to determine the requirements of a control suitable for operation of low thermal capacity electric heating panels.

(4) Experimental results indicated that

(A) Performance with an on-off type thermostat was nearly as good as that obtained with a modulating control, and was quite satisfactory for residential applications.

(B) When on-off thermostats are used, optimum comfort and heating performance will be obtained when the total operating differential is small—of the order of 1.0 to 1.5 degrees F.

(C) Variation in cover design and finish indicated that optimum room conditions existed when the covers had a high emissivity and a minimum number of perforations, thus producing high radiation sensitivity.

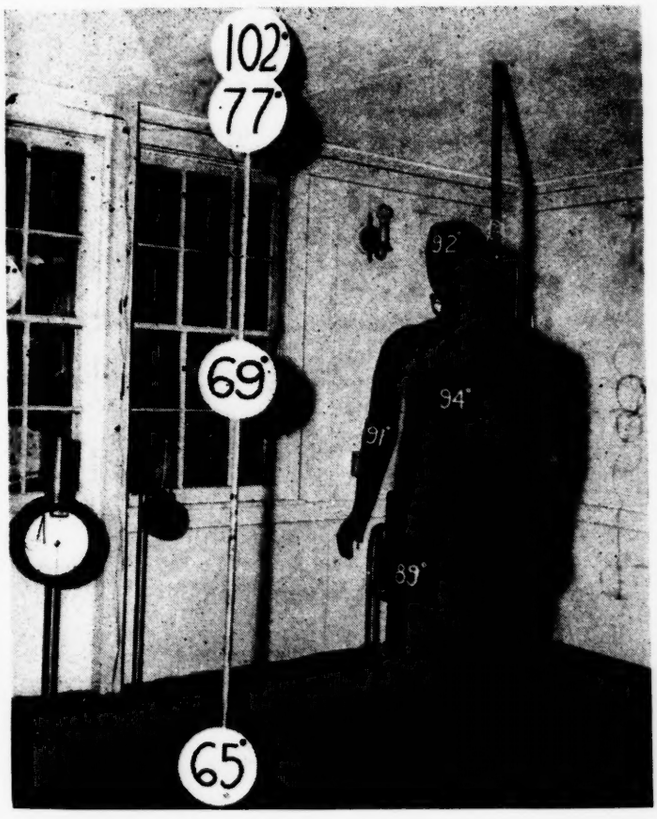
(D) When operation occurred with a thermostat placed on an exterior wall, the test room was overheated.

(5) A specification has been presented for thermostats to be used in conjunction with electric ceiling panels of low thermal capacity.

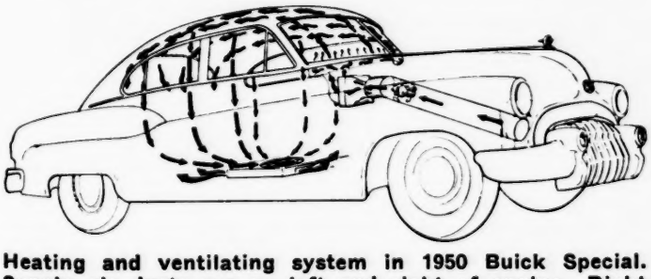
Acknowledgment

The authors wish to acknowledge with thanks their indebtedness to the United States Rubber Company which supplied the heating panels and sponsored the tests, and to the following members of the Pierce Foundation for their helpful advice and assistance: Mr. G. M. Rapp, assistant executive director, and Mr. N. H. Spear, research physicist.

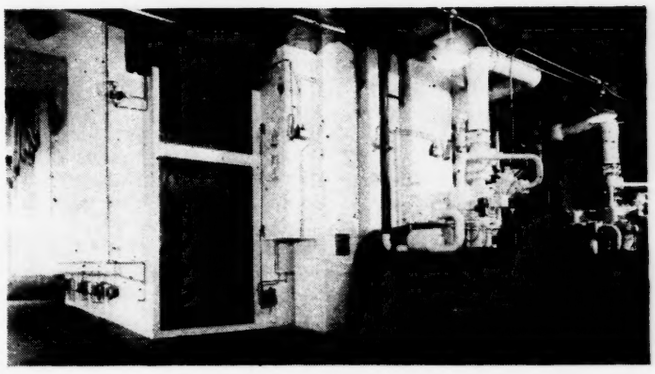
Picture Paragraphs



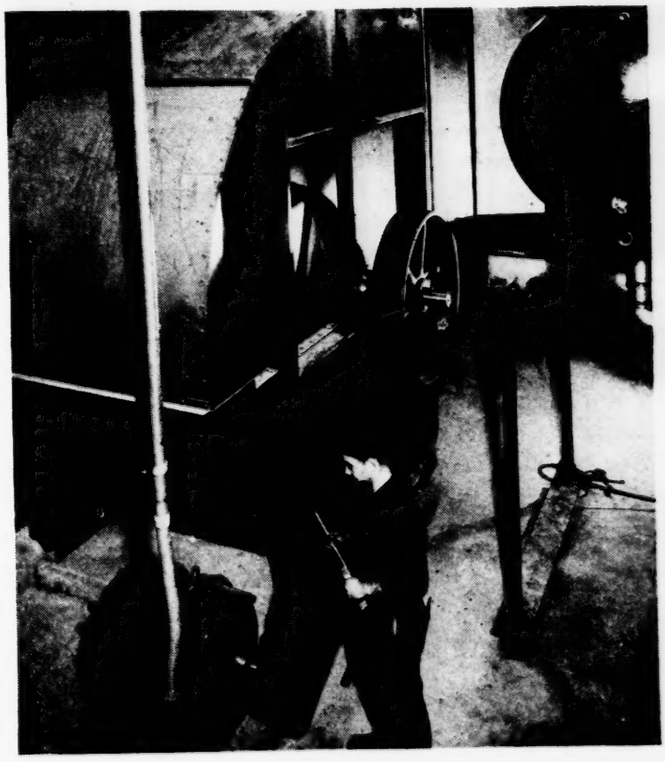
Electrically heated manikin used as a giant "black body" thermometer, integrating the effects of air temperature, surface radiant temperature, and air movement in an electrically heated test room at the John B. Pierce Laboratory of Hygiene. Temperatures in shell spaces surrounding test room can be controlled between 0 and 120F.



Heating and ventilating system in 1950 Buick Special. Supply air ducts are on left and right of engine. Right duct includes defrost unit, which can be by-passed at driver's will. Under-seat heater warms car interior.



Main air conditioning equipment room in basement of Cincinnati Chemical Works, Inc.'s new administration and research center by The Austin Co. Two 60-ton Carrier compressors serve 14-zone system.



Sirocco fan supplies 105,000 cfm to assembly building at Perfection Stove Co.'s Ivanhoe Road plant in Cleveland.

Thermal Capacity of Warm-Air and Cool-Air Ducts

B. F. RABER* and F. W. HUTCHINSON*

The accompanying graph, with illustrative examples explaining its use appearing on this page, enables the user to determine either the heating or cooling effect obtained for a given area of duct, room temperature, supply air temperature, and air velocity, or, if the heating or cooling effect, room temperature and supply air temperature are known, to determine the duct area or air volume needed.

WHETHER for summer air conditioning or for comfort heating, the primary purpose of a duct system is to provide transportation not for air, but for energy. In an air conditioning system the duct carries heat *from* the occupied room, whereas in a comfort heating system the objective is to carry heat *to* the occupied space, but in each case the effectiveness of the duct depends on its ability to convey an adequate quantity of useful energy between the heat sink (as an evaporator) or the heat source (as a furnace) and the occupied space. Thus, evaluation of the thermal effectiveness and the thermal adequacy of any duct system depends only on a knowledge of the *quantity* of heat which can be either released or absorbed by the working substance (air) which flows through that duct.

In actual practice many considerations, such as noise level, power requirements, and fabrication cost, will influence the size and type of duct which is selected. Thermally, however, the system can be judged good or bad, adequate or inadequate, solely from a determination of the quantity of energy which it transports. The intent of this article is to present a simple graphical method of checking the thermal capacity of duct systems, whether for warm air or for cold air, for use by the designer in obtaining a rapid check on his overall design and for use by the operating engineer in readily converting his basic test data to thermal terms.

The accompanying full-page graph permits direct evaluation of heating- or cooling-effect from a knowledge of the velocity and temperature of the air within the duct and the duct cross-section area in square inches. By arbitrary selection the base scale, expressed in Btu per hour, indicates the quantity of sensible heat present in air at the selected temperature over that quantity which would be present *if the air were at zero degrees Fahrenheit.* Thus, if air were flowing at 1,200 feet per minute through a 7 in. $\times$ 8 in. rectangular duct, and if the air temperature were 90F, the quantity of heat carried in the duct could be obtained by entering the base of the graph at area of $7 \times 8 = 56$ square inches and rising vertically (see dashed example line) to intersection with the radial for air velocity of 1,200 fpm; from this point move horizontally to the right to intersect the radial for 90F, then drop vertically to the lower base scale where the thermal capacity of the system is read as 43,000 Btu per hour *above zero F.*

With accuracy more than satisfactory for average engineering application the graph can be used directly to determine the thermal capacity of a duct system relative to any room delivery air temperature. Thus if air at 160F were flowing at 1,200 fpm through a 56 square inch duct and if this air were delivered to a room at 70F the amount of sensible heat introduced by the incoming air would be determined by the same procedure as in the previous example (and using the same dashed example line on the graph) except that the radial temperature line on the graph is now interpreted as temperature difference $(160 - 70) = 90$F between duct air and room air. Thus the heating effect is 43,000 Btu per hr. If the air flowing in the duct is at a temperature lower than that of the room the graph is used in exactly the same way (with radial lines showing temperature difference), but the answer read from the scale marked heating effect is now the *cooling* effect of the incoming air. For example, using the 56 sq in. duct, 1,200 fpm, with air flowing at 60F and the room air at 90F, the temperature difference is 30F and the cooling effect is found to be 16,000 Btu per hour.

An added volume scale, shown at the left side of the graph, permits either determination of heating effect directly from volume, or determination of volume from known duct size and air velocity. For the examples already discussed the method of volume determination is as shown by the dashed example line leading to the left.

Methods of use of the graphical solution are reversed for testing and for design. The test engineer knows temperature, velocity, and duct size by measurement, hence he uses the graph in the manner shown by the dashed line. The design engineer, on the other hand, knows the required heating effect—by calculation—and usually knows the permissible air velocity as determined from noise considerations; he therefore uses the graph to determine the volume corresponding to a selected temperature difference or the required duct area corresponding to a selected temperature difference. In other cases the graph can be used to determine the heating or cooling capacity of an existing duct system in terms of various values of the air temperature (or temperature difference) and of the duct velocity.

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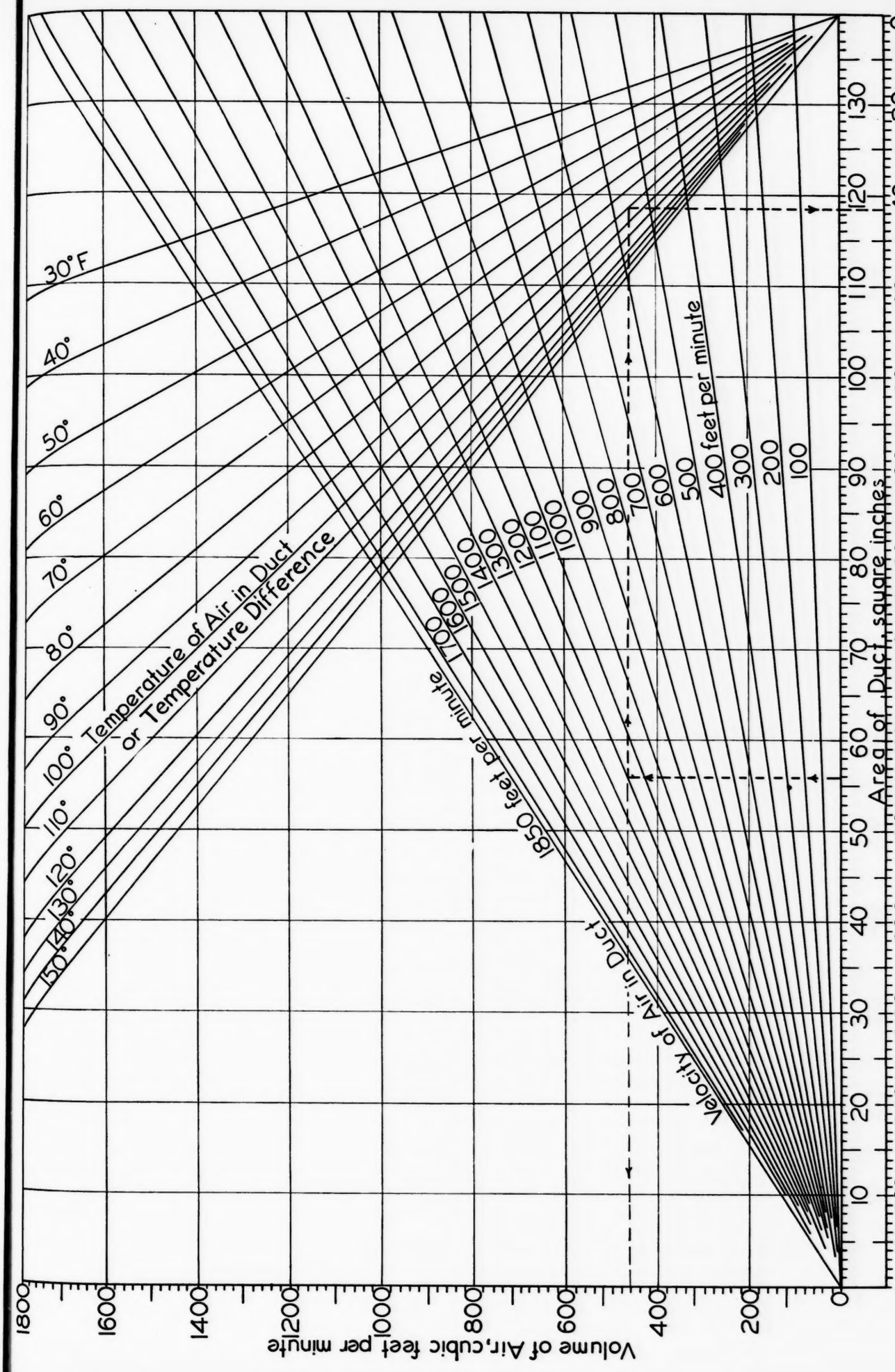

Graph for determining heating or cooling effect of air. To use, move vertically up from the horizontal duct area scale to the proper velocity curve, thence right to the temperature curve, thence vertically down to the horizontal heating effect scale. If the temperature lines are used as temperature of air in duct, answer will be heat quantity *above zero F*; if the temperature lines are used as temperature *difference* between duct air and room, answer will be heating (or cooling) effect. Scale at left shows volume of air.

Recent Higher Court Lawsuits Involving Heating Equipment

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A number of recent court decisions are reported briefly to illustrate points of law that should be of interest to the heating contractor and others concerned with heating equipment. References are given to the cases reported.

RECENTLY a reader wrote as follows: "If a heating contractor makes a contract to install heating equipment and the usual clause in the contract guarantees that the equipment will heat the building to 70F, can the contractor collect on his contract price if the equipment will not heat the building to 70F during an unusually cold spell?"

The answer to this question is given in simple words by the higher court in the case of Biggs v. Densmore, 80 N.E. (2d) 38. This court explained that a contractor is obligated to comply with the exact terms of his contract, no matter how difficult it is for him to perform. This court also said that no one compels a heating contractor to include a guarantee in a contract, and so long as the guarantee does not violate a valid law the contractor is fully obligated. The testimony in this case showed that a contract was in the form of a written proposal or specification, accepted by the building owner, for the installation by the contractor of an oil heating system in the building. The proposal stated: "It is the intent of this specification to cover a complete heating system and have ready for the use of the owner. We guarantee to heat the house to 70F at all times...."

The owner refused to pay the contractor $1,635 due and the latter filed suit. During the trial the building owner proved that the system when completed by the contractor would not heat the house to 70F during cold weather.

In view of this testimony the lower court refused to order the building owner to pay the contractor *any* money. The higher court approved the verdict, and said:

"The judge ruled that the language of the plaintiff's (contractor's) specification.... bound the plaintiff (contractor) to install a heating system capable of heating the house to a temperature of 70F. The finding was not inconsistent."

For comparison, see Cullen v. Sears, 112 Mass. 299. This court held that if a contractor proves *substantial* performance of the contract with comparatively *slight* deviations, and with an honest intent on his part to perform, he can recover the contract price, deducting what the heating system as installed "was worth less to the property owner by reason of such deviations."

In other words, if a heating contractor unintentionally deviates *slightly* from his specifications, or his guarantee, he may recover from the property owner the contract price *less* the amount of money the property owner spends to make the heating system equal the contractor's specifications or guarantee.

Saved Thousands

It is well known that heating equipment permanently connected by a contractor to real estate cannot be removed although the building owner refused to pay the contract price. However, according to a recent higher court a contractor can secure himself by *not* tightening heating equipment with wrenches.

See Dermer v. Faunce, 62 Atl. (2d) 304. The testimony showed that a heating contractor installed heating equipment, materials and labor in a building. The contractor filed suit and asked the court to allow him to remove from the building all radiators, heaters and loose pipes and fittings.

The property owner argued that the contractor could not remove any of these items because they had become a part of the real estate. The testimony introduced by the contractor showed that he had attached the radiators only temporarily by tightening the parts by hand and same were not tightened with a wrench.

The higher court permitted the contractor to remove the hand-tightened items from the property. This court said:

"... The radiators were not tightened with a wrench and were not connected to the boiler, and had not yet lost their character as personal property."

Special Damages

According to a recent higher court a heating contractor who installs a definitely defective furnace may be liable not only for *ordinary* damages but he is also liable for special or additional damages.

For example, in Horwitz v. Teague, 48 S.E. (2d) 697, a property owner sued a heating contractor for damages and testified that the contractor was grossly negligent because he failed to install the heating system specified in his contract. The property owner testified that his home was without sufficient heat for most of the winter, and as a result thereof his wife and three small children became ill and suffered severely from colds and influenza; and that he, the property owner, had suffered embarrassment and humiliation in that he was unable to invite any guests to his home due to the intense cold therein.

The property owner asked the court to award $2,000 general damages; special damages $75 for doctor's bills and drugs, $100 for time lost from his business in trying to make the furnace operate; $200 for loss of his wife's services; $212.50 paid the contractor on the contract; and $110 for the value of the old furnace

removed by the contractor from the home. This court held:

"The petition stated a cause of action for the recovery of general damages, nominal damages, and punitive damages, as the evidence might show."

Total Disability

According to a recent higher court an injured employe can work at high wages for a new employer and yet receive compensation under the State Workmen's Compensation Act from his old employer.

In Brown v. Continental Company, 22 So. (2d) 758, it was shown that a heating contractor's employe performed work of a common laborer. While engaged in unloading pipe a heavy skid was knocked out of its place, and struck him on his back. He sustained severe injuries. After he was discharged from the hospital he took up the trade of a welder, and filed suit against his old employer, alleging that he is disabled from performing duties of a *laborer* and is therefore entitled to compensation for total, permanent disability to a laborer. Although he could work as a welder at considerably higher wages, the higher court allowed the claim, and said:

"It is admitted that he earned better wages as a welder. It is not the same kind of work he was doing and he will have a new and different employer."

Veteran Injured

A recent court was asked to decide this question: If a veteran *trainee* is injured is he entitled to receive compensation under the Federal Vocational Rehabilitation Act or the Workmen's Compensation Act?

In Dolezal v. Rizek Company, 199 Pac. (2d) 179, the testimony showed that a heating contractor made arrangements with the Veterans Administration to train veterans. The contractor paid the veterans a small salary and the main compensation to the veteran was paid by the Government. A veteran was injured.

The higher court held that the veteran could receive compensation from the contractor under the State Workmen's Compensation Act.

Also, see E. R. Burget Company, Inc. v. Zupin, 82 N.E. (2d) 897. The testimony in this case showed that the Hamilton Heating Company agreed to take a veteran in training. A veteran was seriously injured when he was struck by an automobile when he was crossing a street to enroll with the Hamilton Heating Company for the course of training. The court held that the injury was compensable as "arising out of and in course of employment". In other words, the Hamilton Heating Company was liable for payment of compensation to the veteran.

Safe Tools

Recently a higher court held that a state law is valid which requires heating contractors to furnish employes with safe tools.

In Davis v. District, 59 Atl. (2d) 208, it was shown that an employe was seriously injured when a ladder furnished by his employer broke. The employer was convicted in the lower court of using or "causing his employes" to use a ladder with wood side rails having a slope in the cross grain greater than the minimum safety standards provided by a state law. The higher court approved the verdict, saying:

"Clearly it is within the power of Congress to impose upon an employer the duty of ascertaining at his peril whether or not his equipment complies with set minimum standards."

All higher courts agree that an injured independent contractor cannot recover compensation under the State Workmen's Compensation Act. Moreover, he cannot recover damages unless he proves that the injury resulted from *negligence* of his employer.

For example, in Wills v. Lehigh Portland Cement Company, 195 Pac. (2d) 574, it was shown that a corporation made a contract with a contractor named Wills to perform designated work. Wills owned and furnished all tools and equipment used on the job. He worked on the job entirely according to his own plans and methods, and was not under control of the corporation's officials. Hence Wills was an "independent contractor".

One day Wills sustained serious injuries. He sued the corporation for damages. In holding the corporation not liable, the higher court said:

"In doing the work he (Wills) used special rigging, which equipment he owned, and he had complete charge of the work; he was his own boss . . . Appellant (corporation) cannot be charged with appellee's (Wills') negligence in exercising his own judgment and conclusion."

Low Bidder

According to a recent higher court, when specifications give precise and full information to prospective bidders as to the nature of the contemplated work, no more than that can reasonably be required. It is sufficient and meets with legal requirements when the specifications furnish the same information to all prospective bidders, to result in intelligent bidding.

For example, in Frank P. Farrell, Inc. v. Board of Education of Newark, 60 Atl. (2d) 304, it was shown that a Board of Education contemplated the installation of a new heating and ventilating system in a public school. The proposal in bids for temporary heat was an integral part of the main heating contract.

Despite the fact that the base bid of Farrell, Inc., was the lower, the contract was awarded to Cohen, the reason being that on the temporary heating, Farrell, Inc., bid $30 additional cost for each temporary radiator and $135 additional cost for temporary heat for a 24-hour day; whereas the Cohen bid on the same items was $20 and $90, respectively. In the minutes of the Board of Education meeting at which the contract was awarded, it was explained that the contract was awarded to Cohen "although the base bid of Max Cohen was $176 higher than the next lowest bidder, Frank P. Farrell, Inc., the difference in the additional proposals which included temporary heat, made the bid of Max Cohen the lowest bid."

In subsequent litigation the higher court approved this method of arriving *at* the *lowest* bid, and said:

"In our judgment the proposal for temporary heat

was an integral part of the main heating contract and we see no merit in the contention that unit prices were not to be considered in deciding the low bidder."

Modern higher courts consistently hold that an employe may receive compensation under the State Unemployment Compensation Act *only* if he has "good cause". In other words, a "laid-off" employe must accept *suitable* employment, or he will be denied unemployment compensation.

In Department of Industry v. Unemployment Compensation Board of Review, 49 Atl. (2d) 260, it was shown that one Bril was laid off. He applied for benefits under the State Unemployment Compensation Act and registered for work. Soon afterward he was referred to two prospective employers. The wages offered were the prevailing wage in the area but considerably *less* than he had been receiving. He rejected both jobs without interviewing the referred employers, and the bureau denied his claim for unemployment compensation. The higher court upheld the bureau and refused to award compensation saying:

"The attitude of this claimant, disclosed by actions, lacks the essential ingredient of good faith. His refusal of referrals without interviewing the employers indicate an application for a vacation rather than for work . . ."

President Binds Corporation

According to a recent higher court a corporation is liable on written or verbal contracts and promises made by its president, if the same relates to the corporation's business.

For example, in Moore v. Knapp, 35 N.W. (2d) 393, the testimony showed facts, as follows: A corporation had in stock several pieces of machinery and heating plants. The president of the corporation verbally told a salesman named Moore that he would be paid "a nice commission," if he sold them soon afterward. Moore got in contact with various industries and was unsuccessful at the price required by the president. Moore reported back to the president that the price was too high. Then the corporation mailed to Moore a letter quoting prices on the machinery that they had for sale, among other items being 12 single Budd heaters, "like new condition," $1,850 each. Finally Moore sold 12 heaters at $2,400 each. Moore filed suit against the corporation and claimed that in conversations before the sale the president told him that he would be paid a commission, the difference between $1,850 each and for whatever he sold them. In subsequent litigation the president denied that he had authority as president of the corporation to bind it by the agreement claimed by Moore.

It is interesting to observe that the jury ordered the corporation to pay Moore $6,600 commissions. The higher court approved the verdict, saying:

"Defendant (corporation) claims it was error for the court to permit testimony on the part of plaintiff (Moore) to be given respecting conversations between plaintiff and Mr. Knapp, the president of the corporation, as to the promising of commission, for want of sufficient authority on the part of Mr. Knapp to bind the corporation having first been shown. We are convinced that the record is sufficient for the jury to draw the inference that the actions of Mr. Knapp were practically the actions of the corporation."

Knowledge of Poor Job

Generally speaking, a heating contractor who installs a defective or inadequate heating system cannot recover the contract price. However, according to a recent higher court this rule of law is changed if the testimony shows that the property owner *knew* the contractor was *not* installing proper equipment and made no complaint.

For example, in Lane v. Gilbertson, 160 Fed. (2d) 211, the testimony showed facts, as follows: The Reed and Lane Heating and Sheet Metal Company installed a heating system in a building during the period when materials were very scarce. The heating system was not adequate to heat the building and was not a first-class job.

The heating company sued the owner of the building for the full contract price and proved that the latter had been present during the installation and knew that the best materials were not being used.

In view of this testimony the higher court ordered the building owner to pay the heating company the contract price and said:

"Since the installation of the boiler and its steamfitting was under the superintendence of appellee (building owner) and with his knowledge of the character of the materials, the evidence required a decision for appellants (heating company) for the value of the services and materials."

Trade-Mark Law

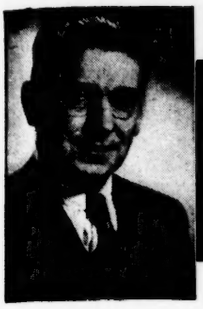
Modern higher courts consistently hold that two competing firms cannot use similar trade-marks and trade names *if the public* is likely to be *confused* and purchase the merchandise of one company believing it to be the merchandise of the other company. Otherwise there is no infringement.

For illustration, in Gould Engineering Company v. Gould Burner and Appliance Company, 68 N.E. (2d) 702, the testimony showed facts, as follows: The Gould Engineering Company sued the Gould Burner and Appliance Company and asked the court to grant an injunction preventing the latter from using a trademark or symbol consisting of a picture of an oil burner within the capital letter G in its business of selling fuel oil. The Gould Engineering Company contended that it had the exclusive right to use this trade-mark both on oil burning equipment and also with fuel oil. The higher court refused to agree and said:

"The plaintiff (Gould Engineering Company) has an exclusive right to the symbol only as applied to oil burners."

Also, with respect to the contention of the Gould Engineering Company that use of the *trade name* "Gould Burner and Appliance Company" would confuse the public the higher court stated:

"No finding of actual confusion appears. Both parties sell to dealers rather than to the public, and dealers are unlikely to be confused."



Experience is my Classroom

By T. W. REYNOLDS

• LIVE AND LET LIVE

Having worked as a sales promotional engineer, a consulting engineer, and a contractor, I think my vision is less clouded about manufacturers than it otherwise would be. I do not think that every manufacturer is out to do me in some way or other and, in fact, I do not believe there is any manufacturer that is out to do anything but live and let live. Neither do I think a manufacturer is out to sell me a bigger boiler than I need; at times I know he is not out to sell me any boiler at all. He recognizes that I will be there or somewhere around to be sold a boiler some other day when I really need one.

Many a time I have had to gently prod some salesman to tell me why I should not use the most expensive line of his products, because he did not put them forward on a job which he felt did not warrant it. Salesmen vary, of course, in degree of character, ethics, capability and personality, but in the long run it's the salesman who gives prompt and adequate service and is pleasing without groveling, who secures your respect and your business. Generally speaking, the salesman of today is a most intelligent and useful fellow to have around when troubles occur in application of the kind of product in which he is so highly specialized.

• HEAT RECLAMATION IN LAUNDERETTES

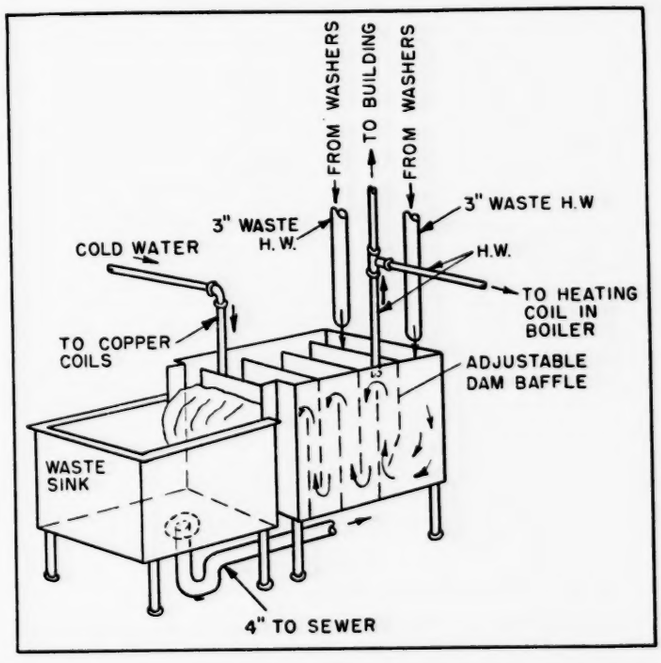
As the launderette becomes more and more popular, it is natural that someone should develop a device for reclamation of heat from the vast amount of hot waste water going to the sewer from the washers, usually about 20 in a single launderette. Many installations started out with 10 to 14 washers and then, as more were added, the boiler, chimney and hot water heater, any one or all, became overloaded, especially so in the winter when the entering cold water is at a lower temperature.

Increasing the capacity of existing equipment, though at a considerable expenditure, is one's first thought when insufficient capacity is involved, but reducing the requirements is the more sensible where this is possible. Thinking along these lines, it was soon discovered that quite often the capacity was under that required only by the amount of heat which could have been reclaimed from the washer water. As a result, a heat exchanger or reclaimer of special design was developed to meet the conditions of non-fouling from soapy and linty waste water, yet with flow retarded not too much, but enough so to reclaim all the heat from this water which is reasonably possible (usually a 25F temperature rise with a 35% saving). See the accompanying drawing.

Since the waste water fluctuates so widely in temperature and volume it is desirable that any sudden surging be retarded and the water temporarily stored, this being accomplished as shown in the drawing by the so-called dam baffle. Each baffle is set higher than the next baffle and, further, may be adjusted to form but a small clearance for passing water between its bottom and the adjacent baffle. These two features, plus a sizable entrance chamber, provide a temporary storage, thus smoothing out the flow, so that the passage of water over the coils will be slow enough for reasonable heat reclamation, but at no time motionless.

As may be seen, cold water enters the heat reclaimer passing counterflow for better heat exchange through coils of ½ inch copper tubing. There is one coil between each high and low baffle, the baffles providing an intimate contact of waste water with the coils. The cold water becoming tempered, leaves to pass to either the water heater in the boiler or to a mixing valve which is tied in with the hot water from the heater.

Quite recently the Association of Military Surgeons of the United States issued a warning as to possible spread of disease in public automatic washers. After a series of tests it was found that the bacteria count



Heat exchanger reclaims heat from waste water of washers.

NOTE: Mr. Reynolds is Chief, Air Conditioning Division, Abbott, Merkt & Co., Engineers, New York.

remaining in each washer after use was very high unless the rinse water used was very hot (160F - 180F) or the washer was cleaned with a sodium hypochlorite solution. The warning added that the temperature is often too low because of fluctuating hot water supply. Should these recommendations be enforced, there would be a still greater need for heat reclaimers, and for two reasons. One would be the obvious one of greater heat reclamation due to higher water temperature, and the other would be the reduction of the temperature of the waste water to where it would be neither destructive to tile sewers and trap seals, or prohibited by municipal ordinance.

• A WELL STRAINED SITUATION

When you get into a locale where there is lots of nice well-water of low temperature for air conditioning you are sometimes troubled with a sand too refined. If it is a fine sand, everyone will tell you that strainers before water controls and coils are useless because the strainers will not stop the fine sand. On the other hand, at other times it is said that the strainers will soon plug with sand, so that we have the paradox of strainers passing the sand, yet stopping it. Be this as it may, I would, however, sooner have them plug with sand and find out that there was trouble with sand than to learn all this after control valves were worn and coils plugged up; furthermore, when the situation finally clears up it is nice to have strainers in place to catch the other things that strainers catch.

When one takes the viewpoint that a strainer will not catch the fine sand, he is viewing a strainer only as a strainer. As a matter of fact, it is also a dirt pocket, since the change in direction within it causes dirt to settle out in the branch outlet of the wye. For the same purpose, scale or dirt pockets are installed ahead of strainers in heating systems, to provide change of direction for settling out, together with additional cleaning and storage of the heaviest particles of foreign matter. This prevents quick fouling of the strainer screens and reduces the frequency of their removal and cleaning. Even though there are dirt pockets, strainers are still required for stopping the lighter and finer materials carried past the dirt pocket, as well as for catching any sediment when dislodged from dirt pockets or other points by sudden flow.

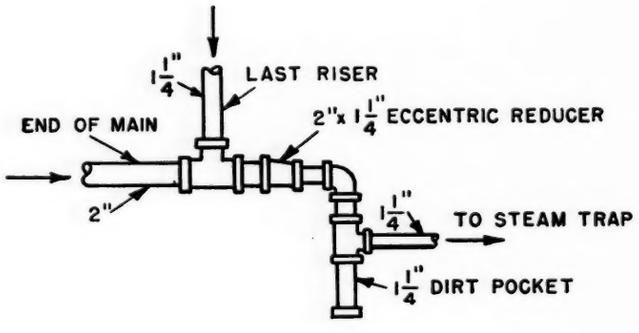


FIG. 1

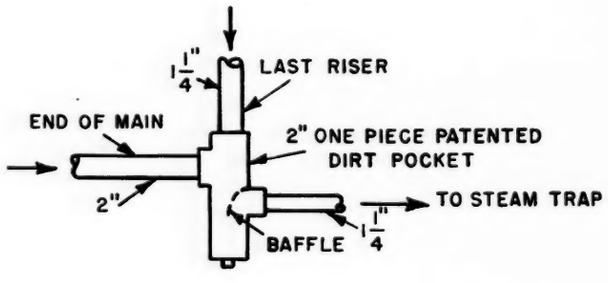


FIG. 2

A well strained situation

When it comes to dirt pockets, the one-piece patented dirt pocket containing a baffle (Fig. 2) is a handy thing. This fitting can be installed in the horizontal or vertical, replacing the commonly used fittings. For example, as compared with Fig. 1, it replaces five fittings and four nipples.

There need be much less worry over sand in strainers if the throttling valves at the water coils on the several floors are throttled for their different water pressures. If this is not done, some coils will be passing by far too much water. The more water passed, the more sand that will be passed along with it, and the more water that is pumped to satisfy this condition, the dryer the well will become and therefore the more sand that will be lifted. Incidentally, the old pot type strainer had more dirt holding capacity, but the demand for the Y-type has been so universal that all manufacture of it seems to have ceased.

• OVERSIZE REDUCED BY ADDING

The strange paradox of adding to that which is too big in order to reduce its capacity, is illustrated in the following account of a condensation pump with a 20 gallon receiver. When the pump automatically cut in to discharge the water content of its receiver, there was too much water for the boiler, then later there was too little as it took a considerable time for the oversize receiver to refill.

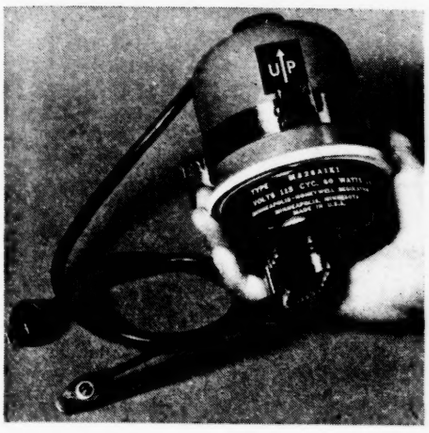
The boiler being a gas boiler, and therefore of small water content, would have made the delay of water return much more noticeable had it not been for the automatic water feeder. This acted promptly to fill the boiler, then later return of water flooded the boiler and water had to be withdrawn. This had been going on for years, becoming more and more pronounced as the system aged and steam traps leaked to delay the return of condensation.

The usual remedy for such situations is a simple adjustment of the float mechanism of the pump to operate more often with less discharge each time. However, and surprisingly, this particular pump had a float mechanism which was non-adjustable. So, because of this condition, some 24 bricks were laid in the pump receiver at the right places to maintain water passages and not obstruct the float or the tank outlets. This reduced the receiver capacity by about 40%. Incidently, bricks were selected of hard glaze to prevent dust coming out and the bricks from going to sand.

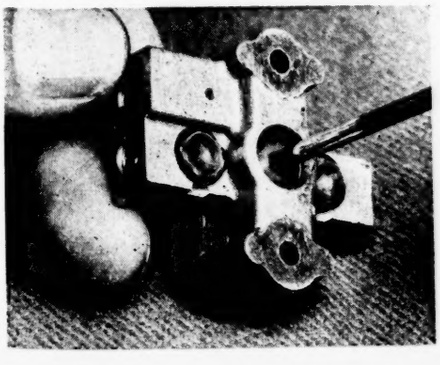
NEWS OF EQUIPMENT AND MATERIALS

M-H Temperature Control

NAME—Electric janitor kit, Y219A.
PURPOSE—A complete installation kit to provide electric-hydraulic temperature control for hand-fired house heating systems.



FEATURES— Device which automatically adjusts dampers and checks, is completely self-contained. The low voltage required for the motor and thermostat is supplied through a built-in transformer from a basement electric outlet. Motor assembly is spring loaded so that in event of electric power failure heating plant dampers will close automatically to guard against excessive heat. Makers claim that by using both electric and hydraulic power the motor can exert sufficient force to position the dampers and checks. Assembly consists of an oil-encased motor (illustrated) which operates a hydraulic pump (illustrated) which, in turn, forces oil against a diaphragm to move the connected arm and thereby, through pulleys and chains, operate the dampers. Pump is a two-cylinder unit, complete with filters and check valve and measures 2 inches long. Motor assembly action is said to be noiseless. Thermostat, developed for this system, is less than half the size of conventional units and is intended to activate short, regulated operations for even temperatures.

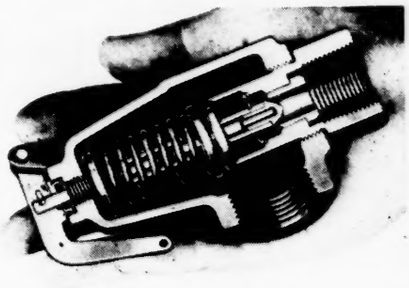


OPERATION—Electric motor starts on a signal from the thermostat to operate the pump which forces oil from a reservoir against the diaphragm. This diaphragm moves the crank arm which opens the dampers. The motor continues to operate until there is no further call for heat, at which point the thermostat cuts off electric power and the spring-loaded diaphragm returns to closed position by opening the check valve of the pump so that oil is forced back into the reservoir.
MADE BY—*Minneapolis-Honeywell Regulator Co., Minneapolis, Minn.*

Item 318

McDonnell Relief Valve

NAME — McDonnell No. 33 safety relief valve.
PURPOSE — Relief valve for hot water heating boilers.
FEATURES — Valve is designed to provide sufficient capacity to dissipate the maximum Btu output of the boiler on which it is installed. Makers claim that unit is capable of taking care of more than 70% of all hot water heating boilers based on I-B-R figures of 1948 boiler shipments. Precision alignment is attained by running stem deep into the valve cone which is of stainless steel hardened and precision ground. Seat is stainless steel machined and reamed to precision tolerances. A testing lever operates independently of the automatic pressure action.

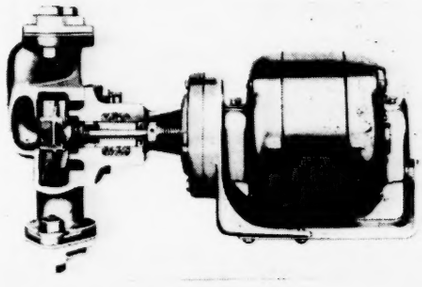


OPERATION—When the set pressure of 30 lb is reached, a needle lifts just far enough to discharge water at the low rate necessary to take care of the thermal expansion of water. If for any reason temperature rises into emergency zone, increased velocity acts on the hydro-lift ring, snaps the valve wide open, to dissipate heat at the rate of 242,900 Btu per hr.
SIZES AND CAPACITIES — Tappings are ¾ inch IPS in the inlet and 1 inch IPS outlet.
MADE BY—*McDonnell & Miller, Inc., Wrigley Bldg., Chicago 11, Ill.*

Item 319

Taco Circulator

NAME—Taco HC circulator.
PURPOSE—Circulator for forced hot water heating systems.

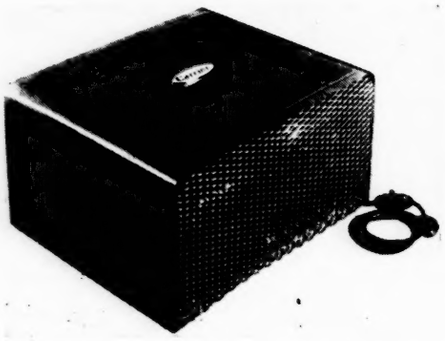


FEATURES—Horizontal circulator is said to provide the extra pumping capacity required for radiant heating systems. Unit has porous bronze Oilite bearings, patented rotary seals, spring drive couplings, stainless steel shaft, balanced cast bronze impeller, two bolt flanges, General Electric motor, interchangeable flanges, and a body that is rotatable for different pumping positions. Makers claim circulator is quiet in operation and is easily accessible for servicing.
SIZES AND CAPACITIES—1, 1¼ and 1½ inches. For the 1-inch size, capacity ranges to 42 gpm at zero head; 43 gpm at zero head for 1¼-inch size and 44 gpm head for the 1½-inch size.
MADE BY—*Taco Heaters, Inc., 137 South St., Providence 3, R. I.*

Item 320

Carrier Dehumidifier

NAME—53F Carrier Humidry.
PURPOSE — Dehumidification unit that operates on a refrigeration principle.

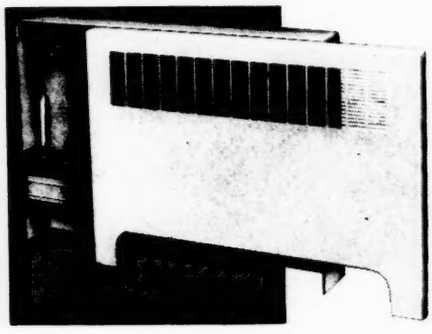


FEATURES — Semi-portable unit is designed for use with 110 or 230-volt, 60-cycle a-c current and with a floor drain for disposal of moisture. Warm humid air is drawn over chilled surface of a copper plate fin type evaporator dehumidifying coil; moisture from the air is condensed, collected on the coil, and drained away. Cool air then passes over the warm condenser surface by forced circulation from a pressed steel fan and is circulated around the room. The 1/3 hp motor is in continuous operation. An expansion valve regulates the flow of refrigerant automatically as it flows to the cool coil. Drain pan collects moisture as it is removed from the evaporator coil for disposal to the open floor drain. A heavy steel receiver, hydrogen brazed, is provided with integral liquid shut-off valve.
SIZES AND CAPACITIES — 18 inches long by 15 inches wide, by 12 inches high and a net weight of 125 lb. With room conditions of 80F and 70% R.H., capacity is 34 pints of moisture per day.
MADE BY—*Carrier Corp., Syracuse, N. Y.*

Item 321

National Convectors

NAME—National Art convector.
PURPOSE — Space heating using either steam or hot water.
FEATURES—Heating element of unit consists of aluminum fin permanently bonded to copper tubes. Spacing used has been designed to prevent clogging with dust. Tubes are silver soldered to heavily constructed cast iron headers to provide protection against leakage and loosening of tubes. A patented process is used for a permanent bond of fin and tube. Header has top and bottom tappings of either ¾, 1, or 1¼ inches. A galvanized steel casing protects the fins in shipment and supports the entire heating element when installed. Enclosures are shipped completely assembled ready for installation. Air chambers are available for use on hot water installations to avoid air accumulation in the unit. Dampers are available for use either at time of installation or to be added later.
SIZES AND CAPACITIES — Available in standard 6, 8, and 10-inch depths, and in heights of 20, 24 and

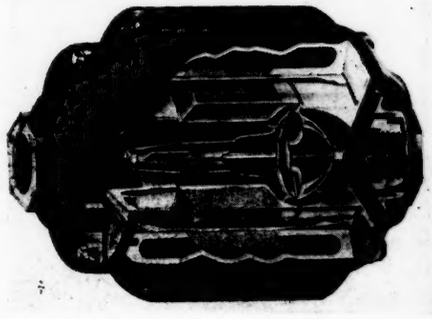


32 inches. Lengths range from 20 to 64 inches in 4-inch or 8-inch increments.
MADE BY—*The National Radiator Co., Johnstown, Pa.*

Item 322

Magnaflow Pump

NAME—Magnaflow pump.
PURPOSE — Circulating pump and motor for hot water heating systems and domestic hot water use.
FEATURES—The direct pipe line mounted circulating pump unit may be installed in any position. Elimination of seals, stuffing-boxes, couplings and centrifugal switches is claimed to avoid the possibility of such service difficulties. Unit is hermetically sealed. The only moving part rotates on a graphite bearing. A stainless steel shaft rotates within the fluid being pumped. Pumping chamber is constructed of stainless steel to eliminate problems due to corrosion. All models are designed for high-head operation and, it is claimed, may be used on any type of heating installation.



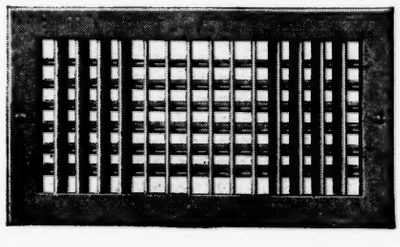
SIZES AND CAPACITIES—1, 1¼, 1½ and 2 inches.
LITERATURE AVAILABLE—Folder.
MADE BY—*Alliance Industries, Huntingdon Valley, Pa.*

Item 323

Auer Register

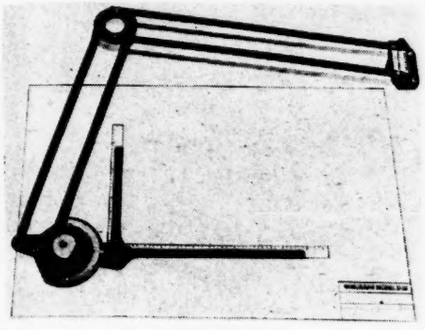
NAME—Auer streamlined register.
PURPOSE—Register for air conditioning and ventilation work.
FEATURES—Included in this series are models with single bank of adjustable bars, either vertical or horizontal and a double bank with front vertical and rear horizontal or front horizontal and rear vertical. All of these types have multi-louver valves in the back. Unit is beveled on the edges to reduce resistance to air flow. Bars are pivoted on special expansion inserts to create enough tension to keep bars tight when set and still be easily adjustable for any directional grouping desired. Shutters of multi-louver valves are pivoted on rivets to prevent vibration on high velocity outlets.
LITERATURE AVAILABLE — Bulletin S-49.
MADE BY—*The Auer Register Co., 3608 Payne Ave., Cleveland 14, Ohio.*

Item 324



Wrigraph Drafter

NAME — Wrigraph drafting machine, model D.
PURPOSE — Drafting machine to

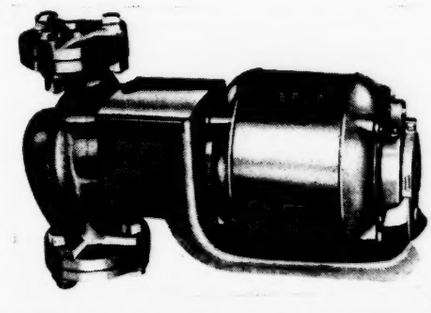


eliminate obstructions on the top of the drafting board.
FEATURES—Instrument is said to permit free movement of the scales over the entire drawing area without interference. Machine is a portable unit that can be fastened to any board or table. The ball-bearing precision drafter is calibrated through eccentric adjustments built into the mechanism. Interchangeable scales in all standard graduations are available.
SIZES AND CAPACITIES — Available for drawing area 20 x 26 inches.
MADE BY—*L. G. Wright, Inc., Box 63AU, Cleveland 21, Ohio.*

Item 325

Trane Circulator

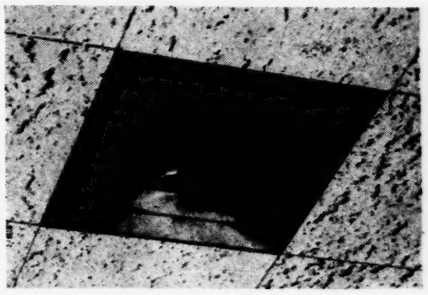
NAME—Trane Model C circulator.
PURPOSE—To provide improved circulation from a hot water system.
FEATURES—This unit which supersedes the Model B circulator is designed to operate against higher heads. This increased head is said to make possible reduction in the size of hot water piping and thereby reduce installation costs. Interchangeable flanges permit one size circulator to fit two sizes of heating system mains. One basic unit may be used for either 1 or 1¼-inch pipe while another may be used for 1½ or 2-inch service. An easy 90 deg rotation of the pump body is all that is required to make the circulator adaptable for vertical or horizontal installations. Increased head is said to be due to improved impeller design. Unit has a single suction enclosed type impeller that has long, smooth curved blades to deliver rate of capacities against high head pressure. Depending on size of unit, motors may be 1/6 to ½ hp. Motor is rubber insulated from the pump and pipe to eliminate hum and operates at 1750 rpm. It is equipped with an automatic thermal safety cut-out to stop motor in case of overload or overheating. A bellows enclosed water seal safeguards against lubrication failure by preventing entry of water into the bearings. On the larger size units, a morganite seal ring is used rotating against a highly machined cast iron surface.
SIZES AND CAPACITIES—1 to 3-inch.
LITERATURE AVAILABLE — Bulletin DS-355.
MADE BY — *The Trane Company, LaCrosse, Wis.*



Item 326

Anemostat Diffuser

NAME—Anemostat Type E square air diffuser.
PURPOSE—To distribute air equally and without draft over a 360° arc.
FEATURES — Diffuser is set flush with the ceiling and fits into standard size acoustical and egg-crate ceilings. It can also be combined with all types of lighting fixtures. Room air, equal to more than one-third the volume of the supply air, is drawn into the diffuser where it is mixed with the supply air before passing into the room in a series of multiple planes. This aspiration effect is said to assure complete air distribution throughout an entire room without drafts and without stale air pockets. A snap-on method of installation permits either installation or removal of the complete inner assembly together with the equalizing deflector. If other than 360° diffusion is required, long, narrow or angular patterns are available.
SIZES AND CAPACITIES — Available in nine neck diameters from 4 to 14 inches.

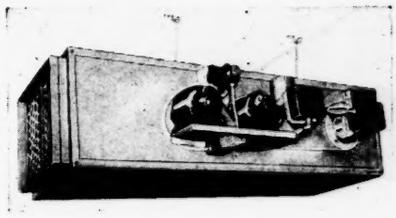


MADE BY—*Anemostat Corporation of America, 10 E. 39th St., New York, N. Y.*

Item 327

Master Kraft Furnace

NAME—Master Kraft, model VCF 75.
PURPOSE—Space heating for home or commercial use.
FEATURES—Although shipped as a vertical floor model, it can be



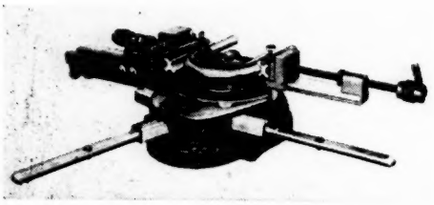
changed to a suspended unit by rotating a few parts. The unit contains two motors, one to operate the blower and one for supplying air to oil spray. Air is drawn into the oil burner through eight individual metered openings. This vacuum is said to push the combustion gases so the need for normal chimney draft is avoided. Heart of unit is made of heavy gage stainless steel. Pressure atomizing burner is built into the furnace. In summer, unit may be used for ventilation.
SIZES AND CAPACITIES—75,000 Btu per hr at the bonnet. Size, 32¾ x 18½ x 65 inches.
LITERATURE AVAILABLE—Folder 4925.
MADE BY — *Harvey-Whipple, Inc., Springfield 1, Mass.*

Item 328

Parker Tube Bender

NAME—Parker hand tube bender, model 848.

PURPOSE—Manually operated de-



vice for bending larger sizes of tubing.

FEATURES—Unit is designed for handling tube up to 3 inches in diameter and accommodates thin or heavy wall copper and aluminum alloy tubes, and light or medium gage annealed steel tube. Bender is operated by hand levers which actuate a central spindle and the attached radius block through gearing. Ratios of 30 to 1 or 8 to 1 may be selected and bends up to 180 deg may be produced. Machine is reversible and tube clamping and radius forming assemblies may be mounted on either side. Bend radius ranges from 1¼ inches to 12 inches.

MADE BY—*The Parker Appliance Co., 17325 Euclid Ave., Cleveland 12, Ohio.*

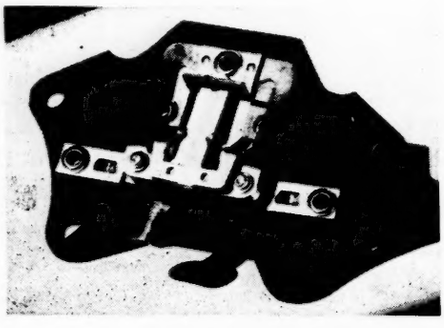
Item 329

Reverswitch

NAME—Reverswitch.

PURPOSE—Switch which permits single-phase motors to have the reversing characteristics of three-phase motors and to provide split-phase and capacitor-start motors with the ability to be started in either direction, reversed instantly, or brought to a quick stop.

FEATURES—Unit replaces the start-



ing switch in motors with centrifugal starting mechanisms and it is said to fit most standard fractional-horsepower motors. The action is mechanical, being similar to conventional starting switches except for having two contacts instead of the usual one. To achieve instant reversing, some type of external controller is necessary.

MADE BY—*Iron Fireman Manufacturing Co., 2838 S.E. 9th Ave., Portland, Ore.*

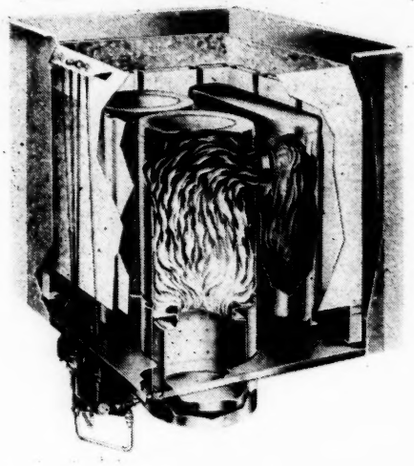
Item 330

Superflame Furnace

NAME—Superflame twin floor furnace.

PURPOSE—Space heating unit for installation under the floor and for use in homes with or without basements.

FEATURES—Unit is fully automatic,



thermostatically controlled and is protected by two thermo-safety bulbs that automatically stop the fuel supply should the furnace become overheated. Two superflame triple combustion burners and two combustion chambers are used so that it is possible to regulate the heat to meet all weather demands. One burner is used in mild weather and two in cold weather. Burners have three stages of combustion so that they can operate with high, medium, or low fire. Burner requires only .04 inch draft. Total heat surface is 2,834 square inches. Unit is available with either dual wall register or floor register. Floor opening required is 34 x 28 inches. Clearance from flue to floor level is 20 inches. Unit is equipped with an automatic draft regulator.

SIZES AND CAPACITIES—Heat output 60,000 Btu per hour. Minimum oil consumption of one burner in 24 hours, 2 gal. Maximum oil consumption of two burners in 24 hours, 13 1/3 gal.

LITERATURE AVAILABLE—Folder.

MADE BY—*Queen Stove Works, Inc., Albert Lea, Minn.*

Item 331

Ilg Kitchen Ventilator

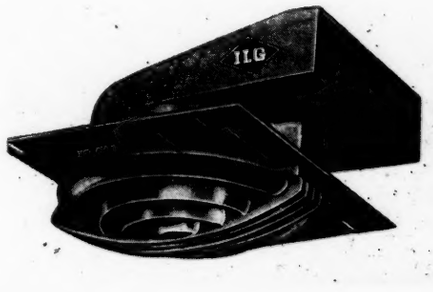
NAME—Ilg ceiling type kitchen ventilator.

PURPOSE—Kitchen ventilation.

FEATURES—Ventilator is controlled by a standard light switch. A swing control on the insulated discharge damper opens the damper when the ventilator is starting and closes it when the ventilator is turned off. Standard 3¼ by 12-inch wall stack duct and elbows are recommended by the maker for use with the new ventilator. Mounting plate is adjustable to permit installation flush with the ceiling. The fan wheel is driven by an Ilg shaded pole rubber mounted motor. The complete grille and fan assembly (illustrated) is hinged so that it may be quickly detached for cleaning. All working parts are easily detachable. When the grille is open for cleaning, the circuit is automatically broken. A heavy gage steel discharge housing is available at the exhaust end for building into brick, masonry, or frame walls.

MADE BY—*Ilg Electric Ventilating Co., 2850 N. Crawford Avenue, Chicago 41, Ill.*

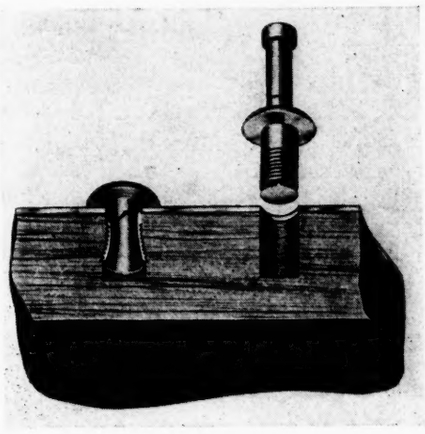
Item 332



Cherry Rivet

NAME—Cherry rivet—pull-through hollow type.

PURPOSE—Rivet with annular serrations adapted for use with soft



metal applications, wood or metal to wood.

FEATURES—In hard woods where driving wood screws becomes difficult, the serrated shank rivet is said to provide an extremely tight, permanent joint easily set up and fastened. When these rivets are used in soft metal, they eliminate tapping and the special inserts often needed with other fastening methods. Makers claim the rivets will carry a tensile load limited only by the strength of the wood in question. Either self-plugging or pull-through hollow Cherry rivets of the standard types can be supplied with serrated shanks on special order.

MADE BY—*Cherry Rivet Co., 231 Winston St., Los Angeles 13, Calif.*

Item 333

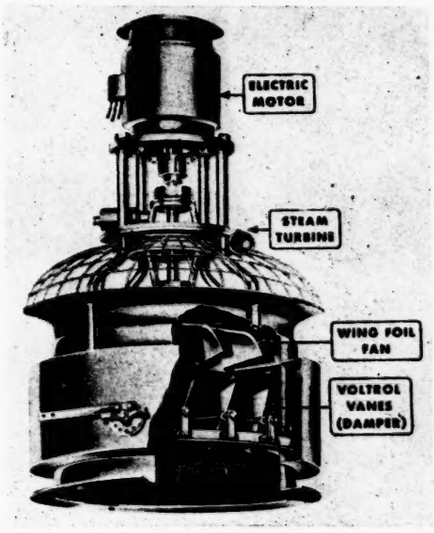
Wing Blower

NAME—Wing forced draft axial flow blower with dual drive.

PURPOSE—Forced draft blower incorporating a combined electric motor and steam turbine drive.

FEATURES — Basic unit of this assembly is the Wing type R turbine blower with a totally enclosed, dust-proof motor connected to an extension of the turbine shaft. A choice of drive may be governed by consideration of heat balance, operating costs, or emergencies affecting the source of power. A change from one drive to another can be made at will. To operate, a switch is thrown for electric drive or valves are operated to use the steam drive. A wide range of control is available with both drives. Throttling gives speed control of the turbine and Wing Voltrol vanes permit capacity regulation for the motor drive. Although model illustrated shows a vertical unit, it may be adapted to horizontal discharge by adding supporting feet. Unit arrives packaged and completely assembled and aligned, ready to bolt to the foundation.

SIZES AND CAPACITIES — Available in various speeds up to 4,000 rpm and in various static pressures and cfm up to 40,000.



MADE BY—*L. J. Wing Mfg. Co., 57 Seventh Ave., New York 11, N. Y.*

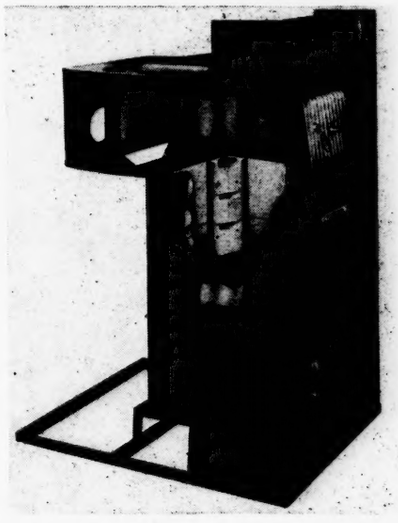
Item 334

Locke Coal Furnace

NAME—Model 900 Warm Morning packaged type coal furnace.

PURPOSE—Space heating with coal as fuel.

FEATURES — Unit, which embodies semi-automatic magazine feed principle, has a fuel capacity of 100 lb. Coal feeds down of its own weight and the design of the unit is such as to permit the coking of bituminous coal. However, bituminous or anthracite coal in a large range of sizes may be used. A built-in automatic heat regulator provides thermostatic control of the primary air. Other features include ball bearing, heavy duty, draw center grates, a built-in humidifier, and a removable ash container with a ½-bushel capacity. Circulating blower can



deliver up to 1250 cfm to provide forced warm air in winter and ventilation in summer. Heat register has 4-way directional louvers.

SIZES AND CAPACITIES—Heat output at bonnet is 80,000 Btu per hour. Height, 54 inches; width, 28 inches; depth, 36 inches.

LITERATURE AVAILABLE—Folder.

MADE BY—*Locke Stove Company, 114 W. 11th St., Kansas City 6, Mo.*

Item 335

Autocon Tank Calculator

NAME — Autocon hydro-pneumatic Tank Calculator.

PURPOSE—A fast and accurate means for determining best high water level in pressure tanks.

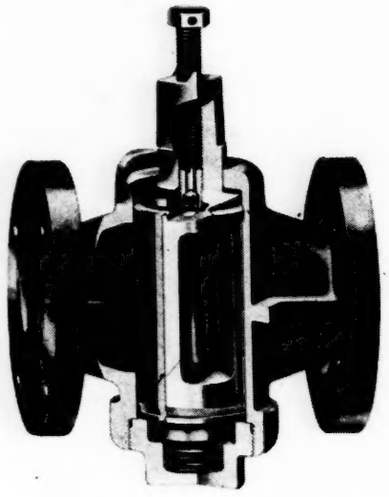
FEATURES — Calculator, which is based on Boyle's Law, tells the best air-water ratio, the most efficient pressure differentials, the exact amount withdrawn on any pressure drop, and the resultant reserve or residual. All computing scales are placed on one side of the calculator and instructions are provided on the back for convenience in use. Calculator, which is printed on heavy cardboard, measures 9 x 4 inches.

MADE BY—*Automatic Control Co., 1005 University Ave., St. Paul 4, Minn.*

Item 336

Homestead Valve

NAME—Homestead - Reiser self-sealed valve.
PURPOSE—Valve designed to give long period leakless service.



FEATURES—Valve has a wedge action which not only adjusts itself for wear but also keeps the sealing surface of the plug and body in intimate contact at all times to provide a tight seal against leakage. Line fluid pressure also serves to promote the sealing effect. Among features claimed for this valve are port areas equal to the area of standard pipe, a complete lubricant seal around the ports, and positive, visible stops to limit operation to a quarter-turn.
LITERATURE AVAILABLE—Reference book No. 39, Section 5.
MADE BY—*Homestead Valve Mfg. Co., Coraopolis, Pa.*

Item 337

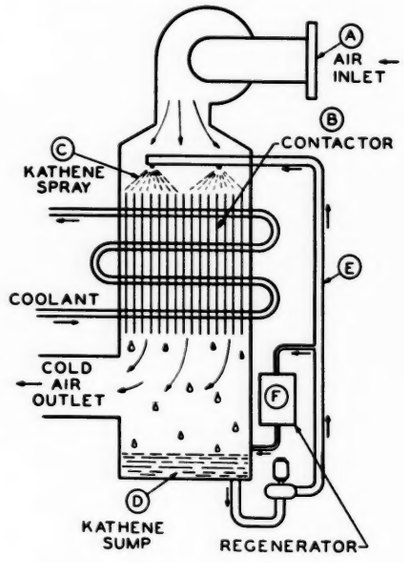
G.E. Electrode Holder

NAME—G.E. miniature inert-arc electrode holder.
PURPOSE—Holder designed for fluxless welding of non-ferrous metals in gages from No. 16 to No. 40.
FEATURES—Unit can be used with either a-c or d-c supply and for currents as high as 60 amperes. Holder is said to be suited for a job wherever (1) the metal to be welded is thin or the parts to be welded are small or hard to get at, (2) the flux corrosion and mess incidental to brazing are intolerable, or (3) the accessibility necessary for spot welding is lacking. Holder is available in two models, one for 0.010 and 0.020-inch tungsten electrodes and the other for 0.040 and 1.16-inch tungsten electrodes.
MADE BY—*General Electric Company, Schenectady, N. Y.*

Item 338

Kathabar Defroster

NAME—Kathabar frostless system.
PURPOSE—To eliminate frost condensation on low temperature heat exchange coils.
FEATURES—System operates by continually spraying an absorbent solution over the cold metal of the heat exchanger. This solution absorbs any condensed moisture and drips down into a sump. From here the liquid passes through a regenerator which extracts moisture from the solution so that it is possible to use the regenerated liquid for the next cycle. This liquid is composed largely of lithium chloride and it is said to remove dust and odors from the air through which it passes. Makers claim that air with a dew-point of —25F can be obtained without actually lowering its temperature below zero F.



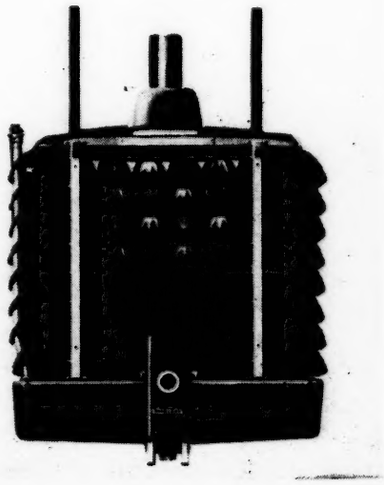
ILLUSTRATION—Air as drawn in at *A*, passes through the contactor, *B*, where it is cooled. Heat is drawn from the air in the contactor and a continuous spray, *C*, of the solution drips into sump, *D*, from where it is backed up by two lines, one of which, *E*, leads back to the spray nozzle where the cycle begins, and the other goes to the regenerator, *F*, where the excess moisture is extracted.
MADE BY—*Kathabar Division, Surface Combustion Corp., Toledo 1, Ohio.*

Item 339

Panelray Heater

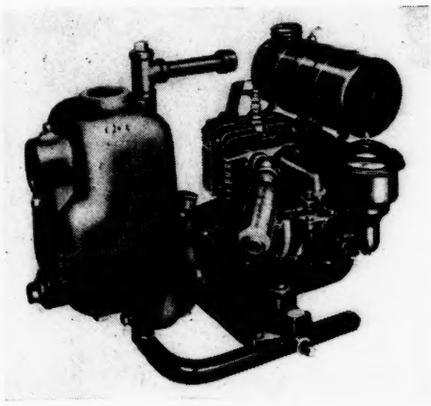
NAME—Panelray.
PURPOSE—Space heating for commercial applications.
FEATURES—Unit is provided with cast iron, drilled port gas burners and a series of louvers which directs the heat downward. The heating element is porcelain lined inside and out. No fans or blowers are employed. Heaters are provided with a Schoenberger A valve, ¾-inch Thermac regulator, and a ¾-inch Thermac diaphragm valve. Uniform temperatures are thermostatically maintained. Unit is suspended to throw heat in all directions.
SIZES AND CAPACITIES—Available in four models with a Btu input for natural gas from 50,000 to 125,000.
MADE BY—*Day & Night Division, Affiliated Gas Equipment, Inc., Monrovia, Calif.*

Item 340



Deming Portable Pump

NAME—Deming portable self-priming centrifugal pump.
PURPOSE—For applications such as drainage or water handling jobs.



FEATURES — Self-priming centrifugal pump is provided with a 1½-hp, four cycle, air cooled gasoline engine having a high tension magneto. Pump has cast iron casing, bronze impeller mounted directly on engine shaft, and a mechanical type shaft seal which is said to eliminate the need for stuffing-box and packing gland. Both suction and discharge connections are 1½ inches.
SIZES AND CAPACITIES—Length, 20 inches; width, 13 inches; height, 19 inches; performance rating, 10 gpm at 80 ft head and 90 gpm at 15 ft head.
MADE BY—*The Deming Co., Salem, Ohio.*

Item 341

Heil Furnace

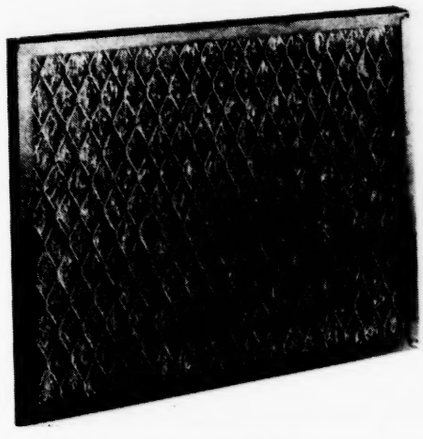
NAME—Heil highboy, models KH-1 and VH-1.
PURPOSE — Space heating unit designed for first floor utility rooms.

FEATURES—Unit is provided with a Heil atomizing pressure burner which is rated at 75,000 Btu per hr, or a Heil vaporizing burner with a 65,000 Btu per hr output. The multiple baffle arrangement and heat exchanger design are said to result in increased efficiency. A wide flexibility is provided in the location of return air ducts. A 10-inch blower is used, powered by a 1/6 hp blower motor. Firebox is constructed of 12 gage steel and flues are of 16 gage steel. Air filter measures 2 x 16 x 25 inches.
SIZES AND CAPACITIES — Based on assumed piping loss of 15%, register delivery is from 55,250 (VH-1) and 63,750 (KH-1) Btu per hr with a normal air delivery from 700 to 800 cfm at a discharge temperature of 150F. Oil consumption with VH-1 is 0.65 gal per hr and for KH-1, 0.75 gal per hr.
LITERATURE AVAILABLE—Folder.
MADE BY—*The Heil Co., Milwaukee 1, Wis.*

Item 342

A-Lum-O Filter

NAME — A-Lum-O dry type air filter.
PURPOSE—Air cleaning.
FEATURES—This is a dry type filter



so that no oil or adhesives are necessary. Tiny barbs are cut into the aluminum wall to catch foreign particles as small as one micron, while the mass of wool itself catches and holds larger particles. Frame is made of heavy gage aluminized steel and a heavy gage expanded metal cadmium plated steel mat is used as retainers on both sides of the filter. Filter can be cleaned by washing with a garden hose. Filter is said to be built to withstand temperatures up to 900F.
SIZES AND CAPACITIES—Up to 1,000 cfm can be handled by a 20 x 20 x 2-inch filter which has 59 square feet of effective filtering surface.
MADE BY — *Metal Wool Division, Carey Electronic Engineering Co., 1880 Clifton Ave., Springfield, Ohio.*

Item 343

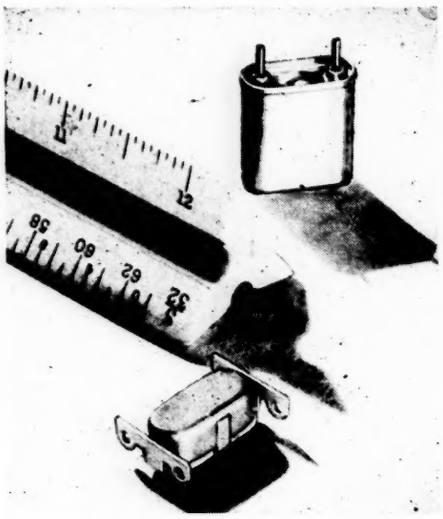
Skinner Solenoid Valve

NAME — Skinner 3-way solenoid valve, series M-3.
PURPOSE—Solenoid valve for applications in air conditioning, refrigeration, and industrial or process equipment fields.
FEATURES—It is designed for use with petroleum oils, kerosene, water, air and inert gases, with operating pressures from 20 to 150 lb per sq in. All metal parts are brass or stainless steel. Soft synthetic inserts are used to prevent leakage, and a spring-loaded pilot to insure positive closing with the valve mounted in any position. Diaphragm is made of coated nylon fabric. Valves may be used for steady or intermittent duty. Maximum power consumption is 10 watts.
SIZES AND CAPACITIES — Available with ⅜-inch orifice and ⅜- or ½-inch N.P.T. ports. Valve is supplied in normally open, normally closed, and directional flow control types. Valve size, 5½ inches high by 2 5/16 inches by 3 13/16 inches.
MADE BY—*Skinner Electric Valve Div., The Skinner Chuck Co., Norwalk, Conn.*

Item 344

Stevens Thermostat

NAME—Stevens type C thermostat.
PURPOSE—Positive operating thermostat designed for control of low-

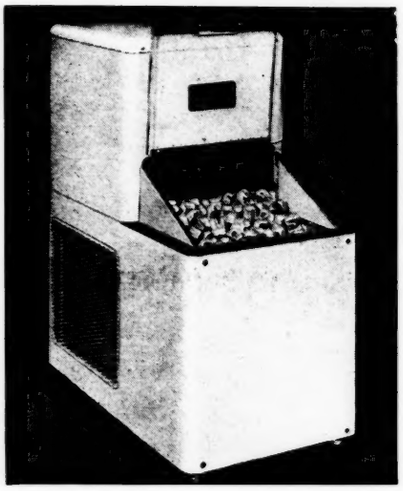


wattage electrical circuits in apparatus and appliances.
FEATURES—Unit can be used alone or in conjunction with disc type thermostats. Makers claim that construction eliminates artificial cycling and thermostat responds only to temperature changes in the controlled device or surrounding air. Two basic types are available; a standard, which is semi-sealed, and the other, which is hermetically sealed in a metal enclosure. A double unit is available set to open at both a minimum and a maximum temperature. Hermetically sealed unit is illustrated at top of photograph and the standard semi-sealed unit in the lower portion.
SIZES AND CAPACITIES — Available with a wide variety of terminal arrangements and in many operating ranges up to 600F.
LITERATURE AVAILABLE—Folder.
MADE BY—*Stevens Manufacturing Co., Inc., Mansfield, Ohio.*

Item 345

Ajax Cube Machine

NAME— Ajax Electric Iceman.
PURPOSE—For automatically delivering a supply of clear ice cubes.
FEATURES—Unit is provided with a Servel Supermetic compressor, model H2B with ½ hp capacity for the air cooled installation; and model WH2B, ½ hp, for the water cooled installation. Unit operates automatically and freezes 156 cubes every 30 min. These cubes drop into an insulated storage compartment which holds 1,400 cubes or 60 lb of ice. The unit stops operation when the storage space is filled. Partial or complete removal of ice causes the machine to start operation. Five quarts of water are automatically fed into the sealed platen evaporator. All during the freezing, water is kept in constant agitation to insure crystal clear cubes. When freezing is complete, a rapid defrosting action takes place. The sealed platen releases slightly to permit siphoning off about one quart of water through a specially designed drain trough. When this is completed the platen is automatically lowered to permit the cubes to drop into the storage compartment.
SIZES AND CAPACITIES—Height, 41

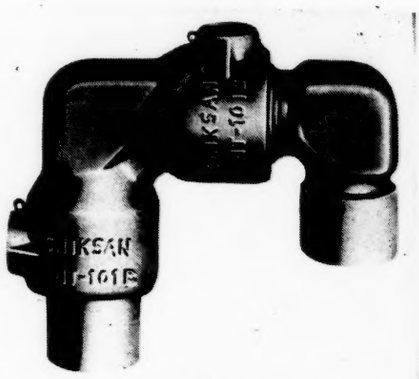


inches; width, 20¾ inches; depth, 34 inches. Output, up to 7,500 cubes every 24 hr.
MADE BY—*Servel, Inc., Evansville, Ind.*
DISTRIBUTED BY—*Ajax Corporation of America, Chicago, Ill.*

Item 346

Chiksan Swivel Joint

NAME— Chiksan high temperature swivel joint.
PURPOSE—To provide greater flexibility in pipe lines handling steam and high temperature fluids.
FEATURES—Joint is designed to operate at temperatures to 600F and working pressures to 300 lb per sq in. Easy turning takes place on stainless steel balls which help to



absorb radial and thrust loads. Metallic seal is said to be fully effective for constant and intermittent service. Unit is available in eight different styles for full 360-deg turning in 1, 2 and 3 planes.
SIZES AND CAPACITIES—¾, 1, 1¼, 1½ and 2 inches, with either threaded or flanged ends.
LITERATURE AVAILABLE—Bulletin.
MADE BY—*Chiksan Company, Brea, Calif.*

Item 347

Baldwin-Hill Cement

NAME — Baldwin-Hill powerhouse finishing cement.
PURPOSE—A finishing cement with a thermal efficiency that approaches insulating cement and which can be used for either indoor or outdoor applications.
FEATURES—Cement is a dry, loose material of mineral wool fiber base with a thermal efficiency that makes it attractive for insulating work. It is said to have low shrinkage and to resist temperatures up to 1700F. It can be applied over any thermal insulating block or plastic insulating cements. Material, it is claimed, can be stored indefinitely and can be applied under adverse weather conditions. It is adaptable for use to both irregular small surfaces and for very large flat areas in either thick or thin layers.
LITERATURE AVAILABLE—Folder.
MADE BY—*Baldwin-Hill Co., 500 Breunig Ave., Trenton 2, N. J.*

Item 348

Microflex Timers

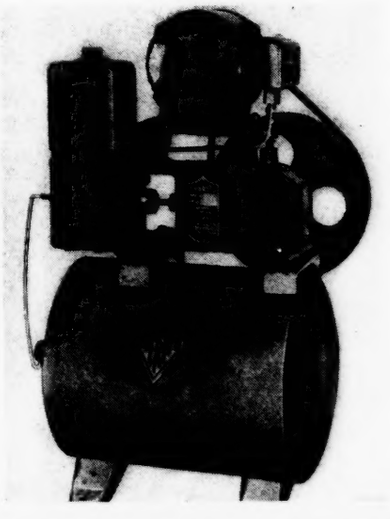
NAME—Microflex timers.
PURPOSE—Timers for controlling electrically operated valves and motors in an explosive atmosphere.

FEATURES—Cast iron enclosure has a machined metal-to-metal seal to make the timer suitable for use in Class I, Group D and Class 2, Group G hazardous locations. A micrometer dial is mounted on the cover of the case for easy visibility and adjustment. Construction is said to provide an accuracy of 0.1 of 1% of full scale. Standard dials are 120 sec, 20 min, 120 min, 20 hr, and 60 hr.
MADE BY—*Eagle Signal Corp., Moline, Ill.*

Item 349

Everite Water System

NAME—Everite water system, model 1950-10.
PURPOSE— Packaged type water system.

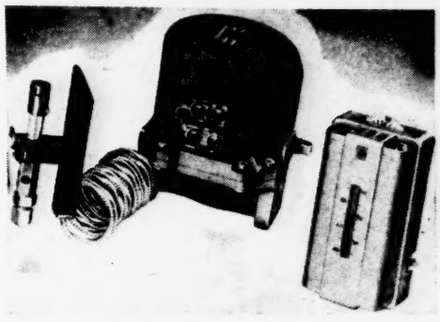


FEATURES—Unit is said to be designed so compactly that it, together with a 10-gal tank, can fit under a kitchen sink. Pump features a one-piece piston to eliminate cup leathers. It has a removable phosphor bronze valve plate which carries all four valves on one plate. A spring-loaded stuffing-box is employed, so constructed that the packing nut can be tightened easily. A built-in bronze screen prevents sediment from entering the pump; an eccentric drive with large bearing surface; and a large air chamber. System has a capacity of 250 gph.
SIZES AND CAPACITIES — Available with 10-, 15- and 30-gal horizontal galvanized tanks, and 15-, 42- and 82-gal galvanized vertical tanks.
MADE BY—*Everite Pump and Mfg. Co., Inc., Lancaster, Pa.*

Item 350

M-H Gas Control

NAME—Y200 powerpile control system for gas-fired heating systems.
PURPOSE—A control system which generates its own electricity to operate a thermostat and automatic gas valve so that the heating system may be independent of power line failure, and also so that gas-fired heating systems may be used in non-electrified rural areas.
FEATURES—System consists of three units—the powerpile, a valve for opening and closing gas flow to the burner, and a room thermostat. The heat leveling thermostat contains a heat anticipator which uses electrical energy supplied by the powerpile unit. This is said to provide extreme accuracy of control by supplying heat to the thermostat, thereby preventing over-shooting. Unit itself is bellows-actuated and uses a mercury switch to eliminate possibility that dust or oxidation might impair thermostat efficiency. From 400 to 500 millivolts are obtained from 25 thermocouples in the powerpile. Electricity is generated as the result of heating two unlike metals joined at one end. The diaphragm valve uses a self-contained polarized relay for added power to open and close the gas flow to the burner. The powerpile is encased in stainless steel and contains a pilot burner. This unit acts as its own safety pilot in case of flame failure and will shut down



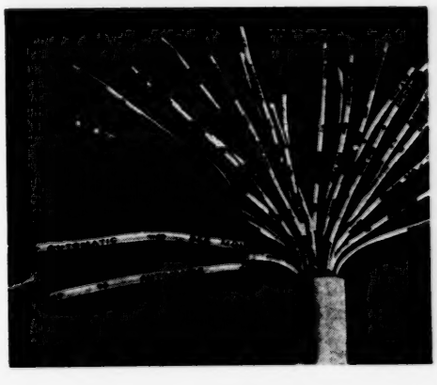
the entire heating plant automatically. System eliminates the need for wiring connections to power lines.
MADE BY — *Minneapolis-Honeywell Regulator Co., Minneapolis, Minn.*

Item 351

Magic Wire

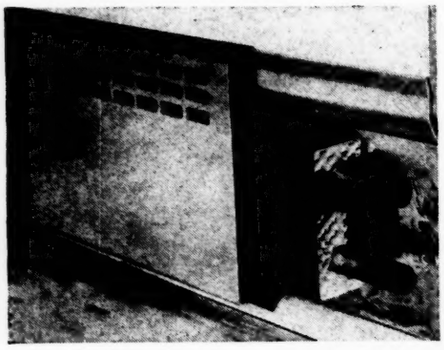
NAME—Magic Wire.
PURPOSE—Electric control wiring with identification on each wire.
FEATURES—Each wire has its code number imprinted in bright red on every inch of the yellow insulation cover and the makers claim that the numerals do not wash or wear off nor become discolored with age. Numbers on the wires can correspond with terminal numbers of an electric control system.
SIZES AND CAPACITIES — Available in No. 16 solid wire with plastic insulation. Other sizes and types available on request.
MADE BY — *Midwest Automatic Control Co., 510 Third St., Des Moines, Iowa.*

Item 352



Brown Baseboard

NAME—Brown Bayce Heet.
PURPOSE—Baseboard type of radiation for house heating.

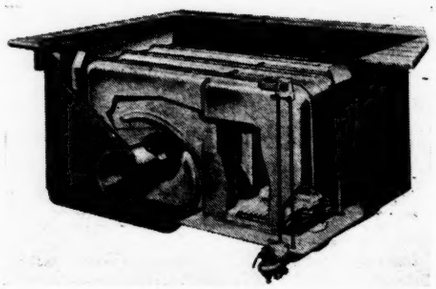


FEATURES—A closed top is used that opens on the front of the unit to prevent wall streaking. Baseboard protrudes 1⅛-inch from wall. Front panel is removable for easy cleaning. Aluminum beaded fins are used to supply greater radiation surface and to provide extra strength for the fins.
SIZES AND CAPACITIES — Available in standard 5 ft units that weigh 12 lbs and require three simple wall brackets for installation.
MADE BY—*Brown Products Company, Forest Hills, N. Y.*

Item 353

Coleman Floor Furnace

NAME—Coleman Shalloflow floor furnace.
PURPOSE—Space heating.
FEATURES—Furnace is said to be water-tight right up to the burner ports, which are only 19 inches below the floor level. Multiple stainless steel burners are used with a honeycomb of small V-shaped ports. The register is fabricated from lightweight steel and is 84% open. An asbestos-sealed combustion chamber door made of pressed steel is hinged so that the register cannot be replaced until the door is closed. Radiator and combustion chamber are shaped and balanced to prevent any noises due to expansion or contraction of metal. Baffles, which are placed into the wall of

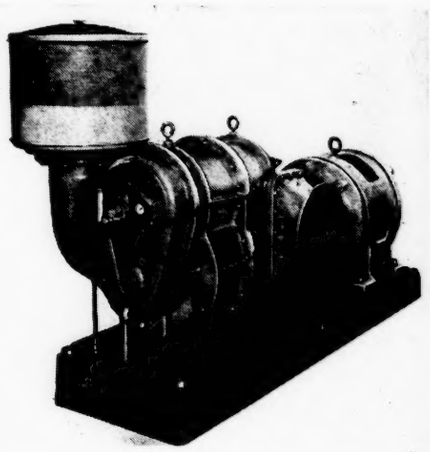


the radiators, are said to provide better heat transfer.
LITERATURE AVAILABLE — Catalog No. 3A.
SIZES AND CAPACITIES — Available in two models with output ratings of 24,500 and 35,000 Btu per hr. Overall size of floor register, 20 x 38 inches and 26 x 38 inches.
MADE BY—*The Coleman Co., Inc., Wichita 1, Kan.*

Item 354

Standardaire Blower

NAME—Standardaire blower.
PURPOSE — Axial flow positive displacement type of blower for indus-



trial applications and for pressures up to 20 lb.
FEATURES — This high speed unit permits direct drive by standard motors. Blower has variable capacities and may be operated from zero to full load. Casing sections are of cast construction, while the gate and main rotors are made of high grade machined metal. Bearings are assembled within the blower casings to assure alignment and positive lubrication. Timing gears are cut from heat treated alloy steels.
SIZES AND CAPACITIES — Available in capacities from 100 to 15,000 cfm and for pressures up to 20 lb.
LITERATURE AVAILABLE — Bulletin.
MADE BY — *The Standard Stoker Co., Inc., Erie, Pa.*

Item 355

Rustrem Paint

NAME—Rustrem anti-rust paint.
PURPOSE—Paint to provide protection against rust.
FEATURES—Product can be applied over rust without wire brushing or scraping to seal the surface and to prevent further rust action. Paint sets in two hours and dries in 24 hours. Paint is said to be suitable for underwater and marine use and is available in black and aluminum.
MADE BY—*Speco, Inc., 7308 Associate Ave., Cleveland 9, Ohio.*

Item 356

SEPTEMBER, 1949

TO OBTAIN FURTHER INFORMATION ON NEW EQUIPMENT

On the list below, circle the item number of the equipment in which you are interested, using the number found at the end of each item.

318	319	320	321	322	323	324	325
326	327	328	329	330	331	332	333
334	335	336	337	338	339	340	341
342	343	344	345	346	347	348	349
350	351	352	353	354	355	356	

Print your name and address, detach and mail to
Editor, HEATING AND VENTILATING, 148 Lafayette St., New York 13, N. Y.

Name.....

Title (Must be shown).....

Firm (Must be shown).....
(For prompt service, title and firm name must be shown above.)

Business Address .....

City.....**Zone**....**State**.....9/49

NEWS OF THE MONTH

SPLIT SYSTEM

to be used in new warm air research residence nearing completion.

The pouring of the concrete slab floor in the new Research Residence No. 3 of the National Warm Air Heating and Air Conditioning Association was completed on July 15th. Now nearing completion, this house is being built by the association at Urbana, Ill., to test the most suitable low-cost heating systems for homes in the $6,000.00 to $10,000.00 price range.

• **TYPICAL.**—Realizing that a large percentage of home construction today is for families having annual incomes from $2,500 to $4,000, the association specified the design of this home to keep it as typical as possible

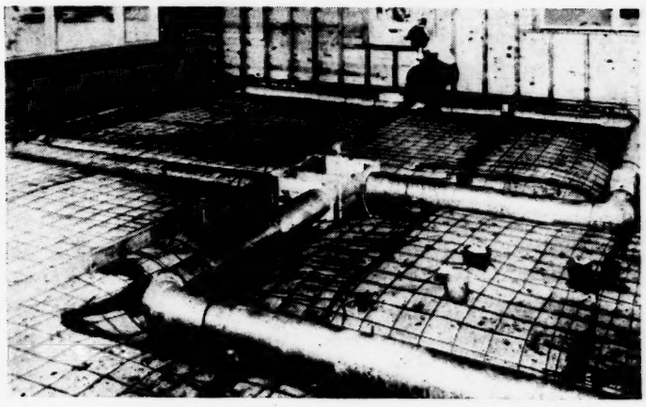
Architect's drawing of Research Residence No. 3.

of those currently being built. No storm windows, weatherstripping or wall insulation has been used in the home, although storm doors are provided. While not approving this type of sub-standard construction, which saves on immediate investment at the cost of long-continued increased operating expense, the association recognizes that this is the prevailing practice in low-cost home construction and that it is a problem which the home heating contractor is meeting in an ever increasing degree. Testing will be conducted for the purpose of finding out how to solve this problem as economically as possible.

• **STRUCTURE.**—Residence No. 3 is a 4½-room basementless, slab-on-ground type of house of standard frame construction above ground. The exterior walls are cedar shingles; the inner sides of the exterior walls consist of ⅜-inch gypsum board with aluminum foil backing. The ceiling is ½-inch gypsum board with aluminum foil backing to serve as a vapor barrier and has 4 inches of mineral wool insulation above.

The pouring of the concrete slab was one of the last major construction jobs to be done on the new residence. All that remains to complete the house before the winter season test program, is the erection and finishing of the interior walls . . . and the decoration and furnishing of the rooms.

The heat transmission, coefficient "U", of the exposed walls is 0.212 Btu per (hr) (sq ft) (F). Using a design temperature of 80F, the heat loss for the home is 42,528 Btu per hr above ground and 6,367 Btu per hr though the slab.



Air ducts in slab before pouring concrete.

• **PANEL.**—Four separate heating systems will be tested in the residence during the 1949-50 heating season. Chief of these will be a system in which warm air ducts are run in the concrete slab in two loops leading from a pit below the furnace toward the outside walls and then parallel to the outside walls so that the loops enclose practically the entire floor area.

The duct (8-inch round) is placed 2 inches below the top surface of the slab. There are 2 inches of concrete below the duct and from 2 to 3 inches of gravel below that. Although it is not recommended by the association to use less than 2 inches of edge insulation in a system of this type where the high temperature source is located near the outside edge, to keep the construction typical of what builders are using today the edge insulation consists of a 25/32 inch asphalt impregnated celotex.

Where there is no duct embedded, the concrete slab is 4 inches thick over a 4-inch gravel fill with a vapor barrier between the gravel and concrete.

• **SPLIT SYSTEM.**—The system actually is a split system, with panel effect being produced by the ducts embedded in the slab and convection effect being produced by introducing the air into the rooms. For the most part, warm air for the rooms will be supplied by floor registers which are located below windows. Exceptions to this are a 14 x 6-inch baseboard register in the dining area, which will be used as an alternate register for testing purposes, and a 10 x 6-inch high wall register in the bath. To test the effect of using long runs, alternate registers are located in the bedrooms.

Return air for this system will be handled by return air grilles located near the center of the house.

A conventional Hi-boy furnace will be used with the warm air forced from the furnace bonnet downward into the pit below the furnace and out through the ducts to the various registers.

Morris E. Childs, special research associate of the University of Illinois will be in charge of testing done at the new residence during the 1949-50 heating season.

COOLING NECESSARY

for berthing spaces of ships in Tropics, U. S. Navy told.

"In order to provide conditions for proper and adequate rest the effective temperature in berthing spaces should be kept below 78F E. T.," and "in order to achieve these conditions in the tropics it is necessary that mechanical cooling of berthing spaces be employed."

This was one of the many conclusions reached after extensive studies on the advisability of air conditioning ships of the U. S. Navy conducted by the Naval Medical Institute here.

The studies were made not only in the laboratory but aboard ship, including some with air conditioned quarters. The research program was designated as Project X-205, eight reports of which have been made. Some of these reports were summarized in the August issue of *Air Conditioning and Refrigeration News.*

In report No. 3, "Physiological Observations Made on Men Aboard Ship During a Shakedown Cruise in Tropical Waters," the conclusions mentioned in the opening paragraph were drawn by Lt. Nello Pace, Lt. Comdr. W. V. Consolazio, and Capt. A. R. Behnke.

Twenty crewmen volunteered for this study, which was made aboard the aircraft carrier *U. S. S. Franklin* during her shakedown cruise in the spring of 1944.

• **HEAT REDUCES OUTPUT.**—"On interviewing various division officers aboard the ship, the unanimous response was obtained that the work output of the men was markedly less as the ship reached the tropics," the report stated. "Furthermore, casual observation during the day revealed large numbers of enlisted men in various out-of-the-way places about the ship lying directly on steel decks below-decks, and in spite of heat, noise, and vibration were apparently asleep. . . .

"There is no doubt that the crew of a ship can fulfill their usual duties for short periods efficiently in the tropics with the present ventilation. It seems equally apparent, however, that this is done with greater individual effort and that initiative is greatly reduced. . . .

"Not only is outside air heated when it enters the ship, but appreciable water vapor is added to it, so that the absolute water content is increased. Thus, under present optimal ventilation by air movement alone, the dry bulb temperature is increased by 7.8F and the absolute water content is increased by 20.2 grains per pound, or approximately 20%.

"Although the addition of heat to incoming ventilation air has been stressed and recognized as a problem, the addition of water vapor has not been stressed and yet presents a physiological problem equal to temperature rise. . . .

"Even with the best mechanical ventilation sleep will be interfered with by sweating. It would thus appear necessary to resort to mechanical cooling of air for berthing spaces in order to provide a physiological acceptable level of 78 E.T.," conclude the authors of report No. 3.

• **MAXIMUM TOLERATION.**—The first report in the series, made by Lt. Comdr. C. P. Yaglou, established maximum levels of dry bulb temperature and relative humidity which could be tolerated by human beings under continuous exposure. In tabular form these tolerances are as follows:

Relative Humidity, %	Maximum Dry Bulb Temp., F
100	90
80	94
60	99
40	105
20	116

How air conditioning for 12 hours or less a day can effectively prevent the occurrence of heat rash and its attendant discomfort and inefficiency among naval personnel in a tropical climate was brought out in report No. 2 entitled "A Comparative Study of the Effect on Men of Continuous vs. Intermittent Exposure to a Tropical Environment."

Two groups of six men each lived in an 85F effective temperature (90F dry bulb and 83F wet bulb) for nine hours daily in this test. One group, the "hot" or continuous exposure group, remained at this temperature for 12 hours at night. The other ("cool") group spent 12 hours at night in an effective temperature of 75F (80F D.B., 70F W.B.). Both groups spent the remaining three hours of the day performing treadmill work tests in an effective temperature of 90F (108F D.B., 83F W.B.).

Numerous physiological and psychological tests were made during the 30-day project, but "of all the objective findings under the conditions of this study, the most striking and perhaps the most important was the difference in incidence of heat rash in the two groups. The fact that the very high incidence of heat rash in the hot group could be prevented in the cool group by intermittent cooling is of high practical significance," declared the seven officers who conducted the program.

"The other objective measures in which a difference between the groups was apparent were the higher basal rectal temperature of the hot group, the higher basal pulse rate, and the higher rate of water loss from the body. . . .

"In addition to the objective findings, certain general observations were made. The members of the hot group reported greater difficulty in getting to sleep and more physical complaints. They also exhibited less spontaneous activity and an appearance of lassitude.

• **FIELD OBSERVATIONS.**—"Although these observations are admittedly subjective, they are in agreement with observations made in the field under comparable environmental conditions, and must be considered in any evaluation of the effects of prolonged exposure to tropical heat. Their importance, however, either in the laboratory or in the field, is difficult to assess. . . .

"A question still remains as to whether exposure to 85F E.T. can go on for longer periods than 30 days without deterioration becoming demonstrable."

In addition to such laboratory tests as the above,

Projects X-205 included studies on actual shipboard installations of air conditioning, including the hospital ships *U. S. S. Tranquillity* and *U. S. S. Consolation*, and the battleship *U. S. S. Washington*.

"The air-cooled hospital ship has become a recognized necessity in tropical areas for the proper treatment of patients," states Capt. A. R. Behnke in report No. 4 entitled "Environmental and Physiologic Studies Aboard Two Air-Cooled Hospital Ships En Route from Norfolk, Va., to the Canal Zone."

"Although statistics are not at hand to indicate the deaths or retarded recoveries of patients in ships not air-cooled operating in tropical areas, medical officers on such ships have stated that high temperature and humidity are major factors in prolonging disability and in increasing mortality of the sick and injured, particularly the burned. Even healthy men subjected continuously to high temperatures show a large loss of fluid and salt and an increased pulse rate indicative of cardiovascular stress," declared Capt. Behnke.

• **DESIGN LIMITATIONS.**—"In designing an air-cooling system for a ship, the engineer is hampered by certain limitations. The amount of cooling equipment he can put aboard, due to weight and other military considerations, is restricted. The Haven class hospital ship, a cargo transport converted into a floating hospital, with all hospital and living spaces air-cooled, is therefore of considerable interest. The cooling system aboard this class of ship is designed to maintain an effective temperature of 76F in tropical waters. . . .

"The chief benefits derived from the relatively cool living atmosphere under conditions of tropical operation were minimal odor in the berthing spaces, absence of sweating in the resting state, absence of heat rash, fewer skin infections, sustained motivation and initiative, and the ability to work that is characteristic of men in a cool environment.

"Outstanding was the fact that personnel could secure adequate rest and sleep in the berthing spaces in the period allotted for sleep," Capt. Behnke said. "Men were alert on awakening, in contrast to the transient stupor frequently observed in those men sleeping in mechanically ventilated spaces in the tropics.

"The contrast between the heat of Panama and the relatively cool air within the ship was especially stimulating. At the start of the cruise some difficulty was experienced in persuading the crew to keep ports and weather access doors closed, but in Panama no special effort was needed. . . .

"The odor level was extremely low in the hospital corpsmen's and crew's berthing spaces, probably due to the absence of sweating, the relatively dry bedding, and the removal of odoriferous material by the cooling coils. In mechanically ventilated ships, odors in such spaces reach objectionable levels," asserted Capt. Behnke.

"In the best ventilated, but not cooled, berthing space where approximately 40 cu ft of outside air are supplied per man, air temperatures are 7 to 10 degrees above weather air temperature and the humidity is increased due to moisture uptake within the ship to give a difference of about five units in effective temperature.

"In the air-cooled ship, the weather temperatures (average 78F E.T.) are seldom exceeded by the compartment temperature, and it is possible to reduce the outside air supply from 40 to 7 or less cfm per man in the interest of economy without deleterious effects or discomforts.

"Air cooling, in which considerable quantities of moisture are condensed out of the air, appears to be effective in removing odors," Capt. Behnke also declared. "Whether it is adequate to take care of the odors associated with certain types of patients is not known. It is possible that individual charcoal units will be required for such patients.

• **'CHILLING' OPPOSED.**—"There is a tendency, especially notable before personnel become acclimatized to tropical heat, for those operating the cooling system to attempt to maintain a 'chilled' atmosphere. This results in too great a difference between weather and compartment temperatures and is thought to predispose to infection of the respiratory tract," he cautioned.

"Studies of the Effects of Air Cooling of Personnel Aboard the *U. S. S. Washington*," as outlined in report No. 6, indicate that "air cooling is not only a significant factor in affecting the morale of the men, but also may be considered as affecting the efficiency and well-being in an objective manner.

"During a cruise of the *U. S. S. Washington* into a tropical area, observations were made on the effects of air cooling of berthing spaces on the performance and well-being of the crew. Two groups of 20 men each (one group was berthed in air-cooled compartments and the other in mechanically ventilated compartments) were used as subjects for a number of physiological and psychological measurements. . . . .

"The mean effective temperature on the navigation bridge during the period Oct. 3 through Oct. 14 (1945) was 76.5F. During the same period, the mean effective temperature of the air-cooled compartments was 76.2F and for the conventionally ventilated compartments, 83.6F. The highest mean effective temperature reached for any eight-hour period in an air-cooled compartment was 80.5F, whereas the corresponding maximum in a mechanically ventilated space was 87F.

• **FEWER COMPLAINTS.**—"In addition to a decided preference of the men for the air-cooled compartments, daily questionnaires revealed a lower number of personal complaints, including loss of sleep, by the men berthed in cool compartments," the report states.

"The men in the non-cooled compartments had a significant decrement in body weight as compared to the 'cooled group' during the period of the study, as well as a small but significant inferiority in performance in speed of decoding. Morning oral temperatures indicated that the 'cooled men' had lower body temperatures. Exposure to heat was not of sufficient duration to cause appreciable heat rash in either group."

In another study, "Critical Factors in Minimal Air-Cooling of Living Quarters," report No. 7 by Lt. Ralph

H. Kellogg, studies were made on a group of 12 youths, previously acclimatized to more severe heat, who were maintained continuously for periods up to four and a half days at each of a series of humidities in the dry bulb range from 76F to 93F (73F to 83F effective temperature).

"Men under these conditions were comfortable, slept well, did not develop heat rash, and were not under excessive physiological strain if the effective temperature did not exceed 78F and the dry bulb temperature did not exceed 85F," concluded Lt. Kellogg.

• **REACTIONS.**—"The subjective sensations of temperature and skin wetness varied with the effective temperature rather than the dry bulb temperature. Interpolation to the mean judgment for 'just right' temperature would place it at about 76F E.T., with 78F E.T. not beyond the comfort range. Practically all skins were reported to feel 'dry' at effective temperatures below 76F, about a quarter felt 'wet' from 76F to 79F E.T., and frequently over half felt 'wet' at effective temperatures over 82F.

"For the regimen employed, the threshold for producing heat rash seemed to lie between 82F and 84F D.B. at high humidity (70 to 80%), and between 87F and 89F D.B. at low humidity (30 to 40%)."

The last report (No. 8) issued, while having to do principally with test procedure, nevertheless may be of general interest to the air conditioning field. In it Lt. Comdr. C. P. Yaglou reports on a "Study of Mean Skin Temperature and Comfort of a Large Group of Naval Personnel Living In a Simulated Battleship Berthing Compartment."

"It appears, in the absence of any conspicuous adaptation influence, that mean skin temperature constitutes the primary factor affecting thermal sensations and, as such, it should offer a reliable index for evaluating effects of temperature, humidity, air motion, radiation, clothing, etc., on the comfort of persons sleeping or engaged in light activities.

"The observations were made in a simulated battleship berthing compartment at the Institute where about 50 enlisted men lived continuously for weeks under controlled thermal conditions averaging about 84F D.B., 71F W.B., and 30 fpm air movement. Although these temperatures lie beyond the range of the summer comfort zone for theaters, offices, etc., it has been shown that naval personnel can become adapted to them and get a good night's sleep.

• **SKIN TEMPERATURE.**—"All subjects were fairly comfortable in air temperatures between 82F and 86F upon waking in the morning. The median of the mean skin temperature was about 92.5, with a minimum of 91.3F and a maximum of 94.5F. Heat discomfort was experienced when the mean skin temperature approached 95F, with a compartment dry bulb of 90F and a wet bulb of 80F. Sensations of cold were associated with mean skin temperatures below 92F when the air temperature was 71F. . . .

"It should be pointed out, however, that reliability of skin temperature is lessened by muscular work, when blood supply to active muscles is increased at the expense of the periphery. The effect of physical work requires further study," concludes Lt. Comdr. Yaglou.

FUEL CHANGES

indicated as natural gas and oil pipelines expand and government research accelerates.

Turning of the valve which let Texas natural gas into storage tanks of the New York & Richmond Gas Co. at Staten Island, New York, marked the beginning of a new balance of fuel energy available to the New York area. Gas will be supplied through the Big Inch pipelines. This is the first supply of natural gas to New York City, and plans of the Consolidated Edison Co. include eventual use of natural and mixed gas in company lines.

• **DETROIT.**—A three-year ban on the installation of home gas heating has been lifted in Detroit. The Public Service Commission originally set up the ban on areas served by the Michigan Consolidated Gas Co. to relieve a tight supply situation in the Detroit area. End of the ban was brought about by new supplies of natural gas which will be piped into the area by Michigan-Wisconsin Pipeline Co. from Oklahoma. The first day after the ban ended, 12,000 home owners applied for permits to convert to gas heating.

• **OHIO.**—Texas Gas Transmission Corp. reports that 200 miles of new pipeline have already been laid on the 800 mile Texas to Ohio line recently authorized. Texas Gas expects to have the line in preliminary operation by the end of the year. After completion of the new line, the Texas Gas system will include 2,366 miles of pipeline and annual sales are expected to reach approximately 150 billion cubic feet, compared with present sales of 50 billion cubic feet annually.

• **OIL.**—Proposed oil pipelines include plans for construction of a 10-inch line by Shell Oil Co. from the Elk City oil field in Beckham County, Oklahoma, to Cushing, Oklahoma, a distance of approximately 160 miles. The new line will be built at an estimated cost of about $4 million and will tap the recently discovered Elk City field to tie in with the newly completed 22-inch, 1,000 mile system transporting crude oil from New Mexico to refineries at Wood River, Illinois. This so-called Basin-Ozark system comprises the largest crude oil pipeline ever built by private capital in America.

• **OIL SHALE.**—The first continuous shale oil refinery in this country has been completed near Rifle, Colorado, as an experimental unit of the Bureau of Mines. Capacity of the plant is 200 barrels a day continuous output of gasoline, diesel fuel, heating fuels, and fuel gas from crude shale oils extracted at the Bureau's oil shale demonstration plant. The shale oil refinery was built under contract with the Refinery Engineering Co., Tulsa, Oklahoma.

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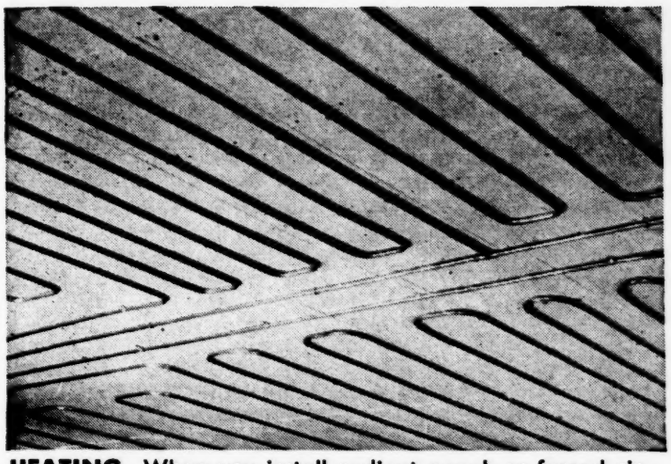

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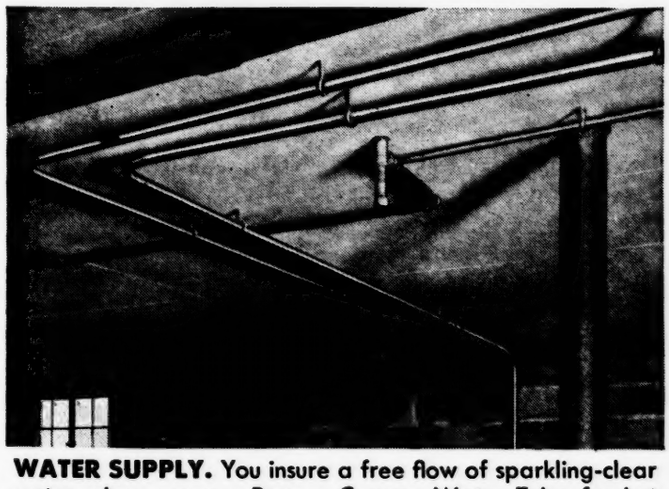
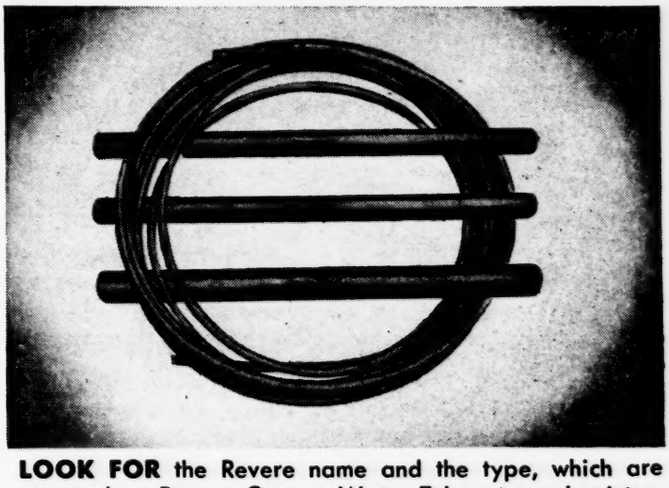


WATER SUPPLY. You insure a free flow of sparkling-clear water when you use Revere Copper Water Tube for hot and cold water lines. And, because copper does not rust, the lines can usually be a size smaller than would be required with rustable pipe.



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Commercial utilization of gigantic U. S. oil shale resources involves a three-fold operation. First, shale must be mined. Second, shale must be treated in retorts to produce oil. Third, oil must be refined into its end products. Operation of the three-fold experimental project near Rifle is expected to answer for private industry some of the technical and cost questions of shale oil refining. All of the Bureau's installations near Rifle—the mine, retort and refinery—will be on exhibition September 20 and 21 as part of a month-long demonstration of shale oil development.

• **LIGNITE.**—Construction of the new Bureau of Mines lignite research laboratory at Grand Forks, North Dakota, was begun July 22nd. The new laboratory in the heart of the country's lignite deposits will be devoted exclusively to research on this high moisture type coal. Because of lignite's tendency to crumble when exposed to air, use is restricted largely to the Dakotas and adjacent areas. Of the nation's estimated 939 million tons of lignite reserves, about 98% are in North Dakota, Eastern Montana and South Dakota.

FEDERAL FUNDS

for hospital construction almost $1.5 billion divided among 864 projects. Possible $151 million for heating and ventilating fields.

Planned or under construction as of June 30 were 864 hospital projects supported wholly or in part by Federal funds.

Of these, 73 projects are new hospitals or additions under construction or in the planning stage for the Veterans Administration. These V. A. projects will add 36,951 beds to the 117,318 beds now maintained in V. A. hospitals in operation. Veterans' hospitals are built entirely with Federal funds, and the total available for construction of new veterans' hospitals is $1,019 million. The President has directed substantial reduction in these funds in the 1950 budget.

A national hospital program administered by the Public Health Service accounts for 791 hospital construction projects which will be in line for partial support by $150 million of Federal funds. Under Public Law 725 (the Hospital Survey and Construction Act) enacted by the 79th Congress, the program is to assist the several states:

(1) To inventory their existing hospitals;
(2) To survey the need for construction of hospitals;
(3) To develop programs for construction of such public and non-profit hospitals as will furnish adequate facilities for all their people; and
(4) To construct public and non-profit hospitals in accordance with such programs.

Individual projects must conform with a State Hospital Plan prepared by an agency of each state and approved by the Public Health Service. A total of $75 million for construction in each of the five fiscal years 1947 to 1951 was authorized with each year's funds to be available for both the year appropriated and the next succeeding year. Federal participation in allowable project costs was established at one-third, hence the $150 million Federal share in the 791 initially approved projects represents a volume of approximately $490 million in new hospital and public health center construction. With 10% of total construction costs allotted to heating, ventilating, and air conditioning services, an estimated $151 million would accrue to those fields through only the two sources of hospital construction money described.

COAL GASIFIER

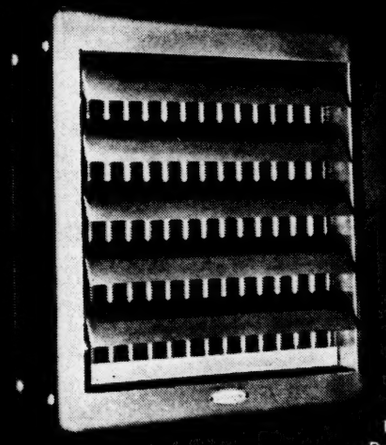
operates satisfactorily in initial tests. Complete liquid fuel plant scheduled for next year.

A significant development in the work on synthetic liquid fuels from coal was disclosed by James Boyd, Director of the Bureau of Mines, with the announcement that a successful full-scale test run had been made in the new coal gasification unit at Louisiana, Mo.

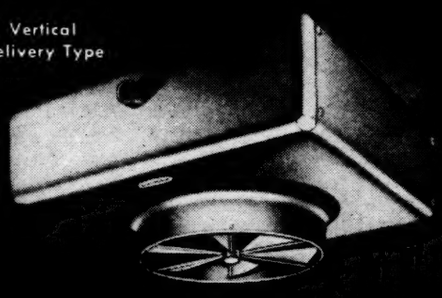
• **OXYGEN.**—A part of the Bureau's gas synthesis (Fischer-Tropsch) demonstration plant, this coal gasifier—probably the largest unit ever installed for direct production of synthesis gas from finely powdered coal and oxygen—is the second of the plant's five units to be completed, Boyd said. An oxygen production unit has been in operation for several months, and it is anticipated that the remaining units for gas purification, hydrocarbon synthesis, and product refining will be finished and in operation during 1950.

Gasification, however, is the No. 1 cost and process problem now requiring solution before competitive gasoline and oil can be made from coal by either of the two basic processes employed in the recently dedicated plants at Louisiana, the Director stated. In the Fischer-Tropsch process, the synthesis gas—a carbon monoxide and hydrogen mixture—obtained by coal gasification constitutes roughly 60% of the cost of the liquid fuel products. In the coal-hydrogenation process, the hydrogen obtained thereby now represents 40% of the product cost. Therefore, a low-cost gasification method applicable to all types of coal is imperative.

• **CYCLE.**—The new type continuous gasifier at Louisiana, installed under contract by Koppers Co., Inc., does not require the use of coking coals. Briefly, its cycle involves first crushing, pulverizing, and drying the coal. Then, suspended in oxygen and accompanied by superheated steam, the coal is fed into both ends of the gasifier—a refractory-lined horizontal steel cylinder with interior dimensions of 6½ by 9 feet. There the conversion to synthesis gas takes place at temperatures up to 2,500F. The unit is designed to use about 28 tons of coal, 24 tons of oxygen, and 35 tons of superheated steam, and to produce some 2 million cubic feet of raw synthesis gas daily.



Horizontal
Delivery Type



Vertical
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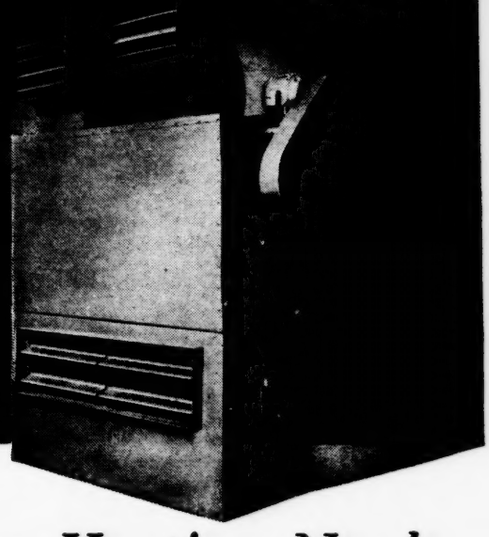

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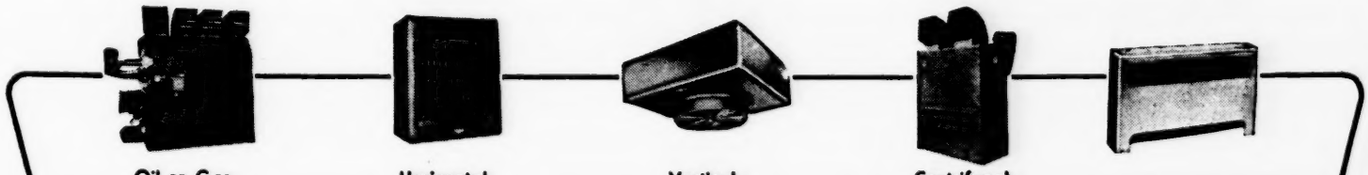

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Steam required for gasifying the coal is superheated in a pebble heater fired by gas. The oxygen is extracted from the air at temperatures more than 300F below zero in a Linde-Frankl unit originally used in making chemicals at Hochst, Germany.

A preliminary 6-hour test run was made in the gasifier on May 4. However, only one of the six burner tubes was used in this initial test conducted below design rates and below normal operating temperatures. There was no evidence of any undesirable trend or condition at the time of the voluntary shutdown.

Recently, as part of a 10-hour period of operation, a 4-hour test was made with all six burners operating at design capacity and with gasifier temperatures averaging about 2,200F. Again the operation was all that could be expected at this stage of the development, and the shutdown was made voluntarily with no conditions in sight that might have forced it.

RADIANT HEATING

proves effective at −50F in Alaska home heating trial.

A report from Ronald R. Twogood, head of Alaska Automotive Center, Fairbanks, Alaska, gives details on performance of a radiant heating system he installed in his own home, in an area where home heating is always a current subject for discussion. Last year, when the Alaskan winter dropped thermometer readings to a low of 50F below zero, Mr. Twogood's new radiant heating system—one of several now reported in use throughout the territory—handled the job of heating the Twogood home in a most satisfactory way.

• **COMFORT.**—Mr. Twogood has been in Alaska for eleven years and, like other residents there, he found that winters in which temperatures sometimes drop to 60F below zero can make home life fairly difficult at times. Even in a snug home that he built shortly after the end of the war, Mr. Twogood was unable to secure an even, fresh heat for his home during the worst months of the winter. He investigated the possibilities of radiant heating, but was initially discouraged by local contractors' opinions that radiant heating might be the answer for homes in a more temperate climate, but not for Alaska.

Mr. Twogood took one more good look at himself and his other Fairbanks friends who virtually hugged the furnace every time the temperature took a deep drop. Then he established some inquiries of his own. The result he obtained was summarized in his report to the pipe manufacturer whose product was utilized in the radiant heating system that replaced the former unit.

"Eleven years of cold, but never again," Mr. Twogood wrote. "We are confirmed homebodies until other homes afford the comfort of ours."

• **ECONOMY.**—By "afford," Mr. Twogood elaborated, he did not mean that his heating costs were excessive. "Our home was built during the shortage at the end of the war, and heated with hot air and with hand fired coal at $15 per ton. We now use oil with radiant heat. We are much more comfortable and at the same cost per month."

Mr. Twogood frankly classifies his present dwelling as an "experimental house," and is planning to build a new garage and apartment, both of which will be radiant heated. The following summer he intends to erect a new and larger home. Mr. Twogood, who has sold himself on the merits of radiant heating, is going into the business himself this summer, with headquarters to be located in his new garage.

• **SYSTEM.**—Mr. Twogood's present system consists of iron piping placed under the wood floor between the floor joists. But he is also of the opinion that a radiant heating system would be most satisfactory in that climate when placed in concrete slab, where a minimum of pipe and water temperature will be necessary. He is aware, however, that many home owners will continue to prefer wood flooring, and in this case, slightly higher water temperature and closer centers of pipe will give the desired results.

Mr. Twogood's present experimental home consists of four rooms and bath, with two bedrooms and bath located in the basement. Radiant heating—also experimental—was supplied only to the first-story rooms through the floor, although the coils succeeded in transmitting some heat to the basement rooms from the ceiling. One and a quarter inch diameter pipe was used for the main, while 470 feet of coil piping was 1 inch in diameter.

During the city's lowest temperature reading of last winter (—50F) the home was kept comfortably warm as water circulated through the coils at 185F.

• Results of recent tests at the National Bureau of Standards have shown that several ceramic bodies previously developed by the Bureau have marked superiority, in both strength and creep characteristics at 1,800F and above, over the best available high-temperature metal alloys. Laboratory data indicate that these ceramic bodies, especially designed for use in jet engines and gas turbines, possess special properties required at the elevated operating temperatures of these power plants.

• Start of construction for his experimental residence to field test his ideas on reflective radiant conditioning has been announced by Dr. Clarence A. Mills, professor of experimental medicine in the College of Medicine, University of Cincinnati. The house, deliberately lacking conventional air conditioning, furnace, and insulation, will be a one-floor, flat-roof residence on a concrete slab. Although Dr. Mills and the four architects are members of the university faculty, the project, in which more than 20 individuals and firms are cooperating, has no official connection with the University of Cincinnati or its research foundation.

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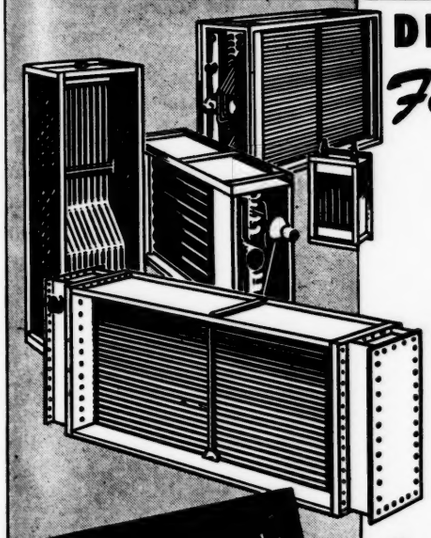

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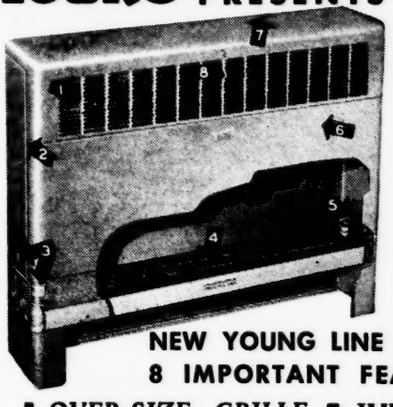

CONVECTOR-RADIATOR ON THE MARKET

Shown: Type "F," one of 6 new, standardized cabinet styles for steam or hot water systems.

NEW YOUNG LINE OFFERS 8 IMPORTANT FEATURES

1. OVER-SIZE GRILLE gives greater heat delivery; louvers direct air outward.
2. EASY-TO-CLEAN CABINETS feature easy-to-remove front panels.
3. SIMPLIFIED PIPING possible with top and bottom header connections and generous cabinet knock-outs.
4. SENSITIVE HEATING ELEMENT, of efficient, non-ferrous, tube-and-fin design, means quicker response to controls.
5. IMPROVED HEATING ELEMENT SUPPORTS permit quick installations and pitching adjustments.
6. MODERN CABINETS may be painted any color; corners are rounded, edges flanged for safety.
7. AIR-SEAL prevents air leaks and wall streaking.
8. DAMPER CONTROL regulates heat flow; permits individual room temperature control.

Be sure to send for complete information on the new Young Line of Convector-Radiators; No obligation.

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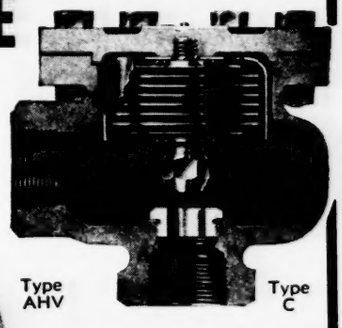
SAVE TIME – Nicholson Steam Traps Require

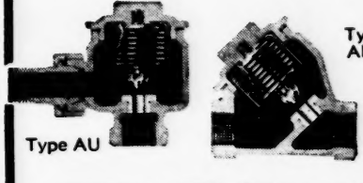
NO CHANGE of Valve or Seat

0 to 225 Lbs.



Type AHV

Type C



Type AU

Nicholson steam traps save the time and trouble of adjusting valves for varying pressures. This feature substantially speeds maintenance and production. Made of hardened stainless steel, the valve is extra large, resulting in from 2 to 6 times average drainage capacity. Both valve and seat are renewable. The fast action of Nicholson traps prevents waterlogging. Installations have increased production of cooking kettles, for example, as much as 30%. Widely specified for preventing damage to thin gauges. Eliminate "cold blow" in unit heaters. 5 types for every application. Size ¼" to 2"; pressure to 225 pounds. BULLETIN 1047.

W. H. NICHOLSON & CO. 199 OREGON STREET WILKES-BARRE, PA.

Valves ★ Traps ★ Steam Specialties

Abstracts AND Reviews

Publications abstracted in this department should be ordered direct from publisher.

REFRIGERATION FUNDAMENTALS

The American Society of Refrigeration Engineers has published its much heralded Refrigeration Fundamentals, the sixth edition of basic refrigeration information. The last basic data volume appeared in 1943, and it is the intention of the society to issue this volume in odd numbered years such as 1949, 1951, etc. The companion volume on refrigeration applications will be published in the even years.

This volume was prepared under the editorship of B. H. Jennings, chairman, department of mechanical engineering, Northwestern University, with the 42 chapters of the book prepared by 50 outstanding refrigeration authorities.

Practically all of the text matter of the previous edition has been rewritten and the amount of tabular material has been greatly extended to supply the latest data on refrigeration operation and design factors. New psychrometric charts developed for ASRE and covering an extensive range from low to high temperatures are included, along with complete discussions of their use and application to air conditioning and refrigeration.

Refrigerant tables have been expanded and recomputed to give more convenience in their use, particularly in the superheated vapor range. Many charts covering the newer refrigerants, particularly the Freon family, have been added.

The classified section of this book has also been completely revised. It lists materials, components, and accessories concerned with refrigeration and air conditioning.

Refrigeration Fundamentals, edited by B. H. Jennings. Cloth bound, 6 x 9 inches, 940 pages. Published by the American Society of Refrigerating Engineers, 40 W. 40th St., New York 18, N. Y. Price, $7.

DE LAVAL ENGINEERING HANDBOOK

A new edition of this handbook has been compiled by the engineering staff of the De Laval Steam Turbine Co., edited by Austin H. Church and Hans Gartmann. It was developed to facilitate the work of power plant, industrial and design engineers and includes a large amount of basic information.

The material is grouped into seven main sections: Mathematical, mechanical and fluid information of a general nature that applies to one or more of the other sections; steam turbine data; centrifugal pump data; compressor, blower and exhauster information; helical reduction gear; data concerning worm reduction gear.

Each section contains information that should prove of value to the engineer. For example, 48 pages are devoted to turbines. The section covers such points as steam cycles, classification of turbines, turbine performance, turbine design, single stage turbines, multistage turbines, superposed and back pressure turbines, extraction and induction turbines, regenerative feed water heating, governing, and steam and exhaust pipes.

This handbook should supply general information in concise form for the power plant and design engineers.

De Laval Engineering Handbook, edited by A. H. Church and H. Gartmann. Limp binding, 5½ x 8 inches, 265 pages. Published by De Laval Steam Turbine Co., Trenton 2, N. J. Price, $2.

• • •

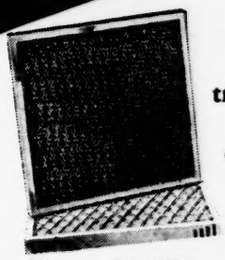
ASA STANDARDS—A 28-page list has been published which enumerates the 1,124 standard specifications, methods of test, building requirements, dimensions, safety codes, definitions and terminology of all the fields of engineering as well as for materials and equipment used by the ultimate consumer. More than 140 new ASA standards have been approved since January, 1949 and are included in this mid-year listing. For a copy, write to The American Standards Association, 70 E. 45th St., New York 17, N. Y.

CONSTRUCTION SURVEY SYSTEM—A 20-page booklet has been issued to describe the construction survey system as a means for eliminating and preventing wastes in estimating, bidding and contracting practices in the building construction field. Price, 10 cents. Construction Surveyors Institute, 101 Park Avenue, New York 17, N. Y.

PSYCHROMETRIC SELECTOR—A psychrometric selector has been designed to simplify the solution of air conditioning problems. Relative humidities are given from 10 to 90%, dry bulb temperatures from 32 to 100F, wet bulb temperatures from 22 to 97F, dew point temperatures from —13 to 96F. This slide or selector, which was prepared by Harry D. Busby, measures 8¼ by 4¼ inches and is printed on heavy cardboard for long wear. Nickerson & Collins Co., 433 N. Waller Avenue, Chicago 44, Ill. Price, $1.50.

HOMES PLANNED FOR COAL OR COKE—The University of Illinois Small Homes Council has issued Circular Series G3.61 covering details for planning the use of coal or coke for house heating. This 12-page bulletin covers plans for one-story basementless houses, one-story home with partial basement, two-story house with basement and the split level type of installation. It not only goes into suggestions for the location of a coal bin and heating plant but discusses and illustrates proper means for removing ashes from the ashpit. Included also is information on bin design for hand shoveling and also for stokers. Small Homes Council, University of Illinois, Urbana, Ill.

*Airsan** Air Filter Protection Means Effective Dust Collection



Airsan expanded metal face plate acts as a lint arrestor to provide easier cleaning and servicing and distributes air evenly over entire filtering area, providing high filtering efficiency and dust holding capacity with low resistance. Other features include all galvanized construction and full bronze welded corners.

Airsan Air Filters available in standard 1" and 2" thickness with filters for industrial and special applications in 2" and 4" thickness.

Holding frames (for V type or straight banks) are made for all type filters.

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Automatic **REZNOR** *gas fired unit heaters*

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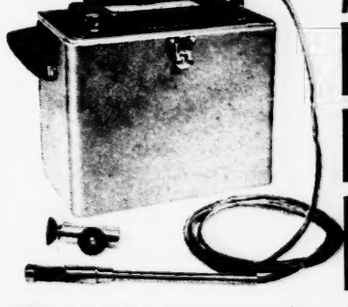
ANEMOTHERM *AIR METER*



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FROM 0 TO 4 NEG AND FROM 0 TO 10 POS IN WG

This precision instrument gives vital data on the performance and efficiency of heating, ventilating and air conditioning systems. Direct, instantaneous readings.

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Get the most out of your Spraying Equipment with minimum power . . . with efficient spraying.

Use Yarway Nozzles. No internal vanes or other restrictions to clog or hinder flow. Two types—Yarway Involute-type producing a fine hollow spray with minimum energy loss, and Yarway Fan-type producing a flat fan-shaped spray with time-saving slicing action for cleaning.

Wide range of standard sizes and capacities. Cast or machined from solid bar stock.

Thousands in use. - - Write for Bulletin N-616.

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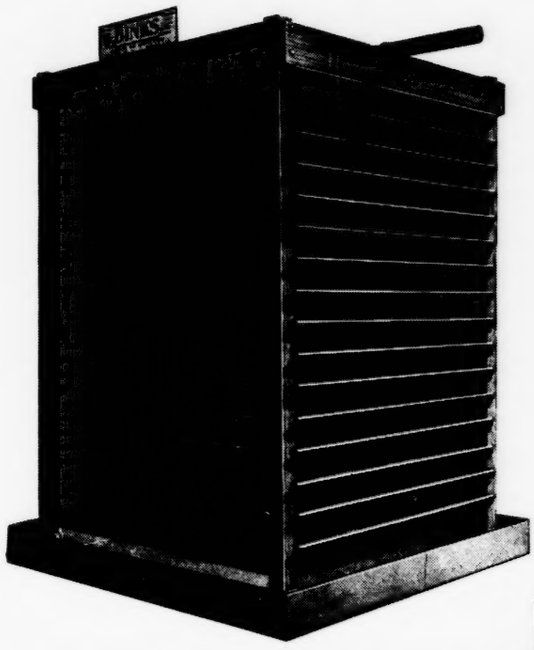
STOKER MANUFACTURERS ASSOCIATION PROCEEDINGS.—Minutes of the meeting held at French Lick, Ind., and the papers presented at the Third Annual Technical Conference are contained in the proceedings that have just been issued by the Stoker Manufacturers Association. This set of mimeographed sheets describe the events that took place at this gathering and also includes the following papers: "Application of Overfire Jets for Smoke Abatement," by William S. Major, development engineer, Bituminous Coal Research, Inc., Pittsburgh, Pa.; "A Smoke Official Looks at the Stoker," by J. H. Carter, Commissioner of Smoke Regulation, St. Louis, Missouri; "What Can the Small Plant Do About Fly Ash?", by Carl E. Miller, technical advisor, Battelle Memorial Institute, Columbus, Ohio. For a copy, write to Stoker Manufacturers Association, 307 N. Michigan Ave., Chicago 1, Ill.

CAST IRON BOILER RATINGS—In a 47-page booklet, the Institute of Boiler and Radiator Manufacturers presents I-B-R ratings for low pressure cast iron heating boilers currently offered for sale by respective manufacturers. These ratings are obtained from tests made in accordance with the I-B-R testing and rating code for low pressure cast iron heating boilers. The information contained in this booklet for the products of 16 manufacturers covers square foot of radiation, Btu per hour, gross I-B-R output in Btu per hour, chimney size, burner capacity, and whether baffles are used. Price, 50 cents. The Institute of Boiler and Radiator Manufacturers, 60 East 42nd St., New York 17, N. Y.

BOILER RATING HANDBOOK—The 1949 edition of the Boiler Rating Handbook prepared by Thomas R. Byrley has just been released. This 80-page paper-bound book has data on heat loss calculations for radiator and boiler size, diagrams for various forms of heating systems and data on both radiation and boiler ratings. The boiler ratings represent the amount of actual standard radiation which the boiler is rated to handle efficiently and with a safe reserve. For each boiler listed there is an illustration showing the outside of the unit. The first edition of this book appeared in 1948 and the second edition has a number of new units not previously listed. Price, $3.00. Fuel Oil News, 1217 Hudson Blvd., Bayonne, N. J.

TURBINE AND BOILER OVERHAUL PRACTICE—A report of the Turbines and Condensers Subcommittee of the Prime Movers Committee, Edison Electric Institute, is contained in this 34-page booklet. This report gives the results of an investigation of the practices of member companies. Thirty members provided data covering overhaul practices for 225 turbines. Part 1 of the booklet covers general practices in connection with the overhaul of turbine-generators and boilers. Part 2 covers methods for inspection of specific items of turbine generators and boilers. Price of publication to nonmembers, $1.25. Edison Electric Institute, 420 Lexington Ave., New York 17, N. Y.



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NATURAL DRAFT COOLING TOWER

Binks Type "WS" Redwood Cooling Towers will provide efficient, trouble-free service on any industrial application. Ready for shipment in 30 standard sizes, ranging from 10 to 1200 GPM.

The product of expert engineering and workmanship throughout, Binks Type "WS" Redwood Towers are prefabricated for easy field assembly by ordinary labor without skilled factory supervision. Recommended for cooling condenser circulating water from refrigeration and air conditioning compressors, water-jacketed machinery, and wherever cooling of water or other liquids is required.

Send now for Bulletin No. 40, giving full information on sizes, specifications and capacities of Binks Type "WS" Redwood Cooling Towers. State tower capacity required.

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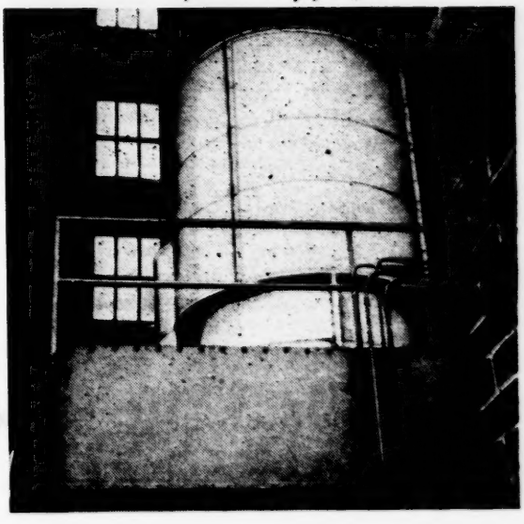

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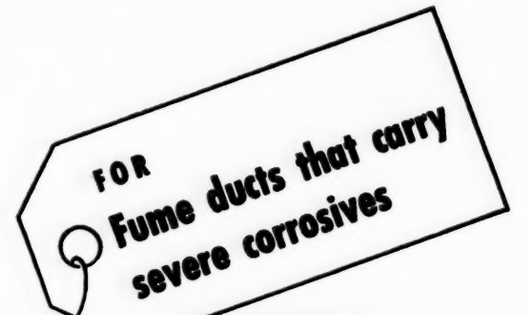

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As Easy To Fabricate As Ordinary Stainless

To give the fume hoods and ducts in your chemical laboratory lasting corrosion-resistance make them of the new Durimet 20 sheet.

This newly developed form of Durimet 20 can withstand really tough corrosives. Its resistance is far better than ordinary stainless steels or even previous analyses of Durimet.

This corrosion resistance is as permanent, uniform and thick as the sheet itself. There is no lining to chip, crack or spall and leave the duct vulnerable. A Durimet 20 duct encloses laboratory fumes with a solid wall of corrosion-resistance.

This special stainless steel can be easily fabricated by methods familiar to ventilating contractors experienced in handling 18-8 stainless. It forms a light, strong, lasting fume passageway. Use it for laboratory table tops, sinks and troughs, too.

Write for Bulletin 502.

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NEW CATALOGS

Pipe and Tank Insulation

Two new leaflets—one illustrating the Grant Wilson line of pipe coverings and the second describing asbestos hot water jackets—are offered. The pipe covering circular illustrates the different types of pipe-covering for hot and cold applications, while the asbestos jacket circular features illustrations of housewives enjoying the benefits of these fuel saving units, and also shows the jacket being applied to a hot water tank.—*Grant Wilson, Inc., Suite 2253, Board of Trade Building, Chicago 4, Ill.*

Item 174

Registers and Grilles

A complete line of registers, grilles, and scoops is described and illustrated in Catalog No. 50, 36 pages, 2 colors. Drawings of construction details and tables of sizes and prices are included. Line includes deflectable outlets, louvers, wall mounting frames, lattice registers, and residential wall and floor grilles. Catalog includes a 5-page section on outlet sizing and engineering data. — *Stewart Manufacturing Co., Inc., 610 Bloomfield Ave., Bloomfield, N. J.*

Item 175

Baseboard Heating

A consumer booklet entitled "The Magic of Baseboard Heating" sets forth the advantages of baseboard radiation in non-technical language from the consumer's point of view. Drawings illustrate advantages and working principles of baseboard heating.—*C. A. Dunham Co., 400 W. Madison St., Chicago 6, Ill.*

Item 176

Tube Fittings

Tube fittings for industrial use, machined from forgings or high tensile bar stock, available for both flared and flareless tubing, are illustrated in a 4-page folder. —*The Parker Appliance Co., 17325 Euclid Ave., Cleveland 12, Ohio.*

Item 177

Combustion Controls

Automatic combustion controls for stationary and marine coal, oil, or gas firing are described and illustrated in Bulletin No. C-22. Controls for steam pressure, air flow, fuel feed, furnace draft, and power are shown with layouts of typical arrangements.—*Ace Instrument Co., Inc., 172 Pacific St., Brooklyn 2, N. Y.*

Item 178

Liquid Filters

Staynew liquid filters for oil, water, chemicals, etc., in a wide range of models, sizes, and capacities are described and illustrated with cut-away drawings and tables of data in an 8-page color bulletin.—*Dollinger Corporation, 11 Centre Pk., Rochester 3, N. Y.*

Item 179

LEE DIRECT WARM AIR HEATING

Higher Efficiency! Greater Economy!

Direct warm air heating is fundamentally the most efficient means of transferring heat from fuel to air, and is especially suited to the heating of industrial buildings of all types, hangars, etc. Lee Engineering Company was one of the pioneers in this field, and today offers a complete line of both central system heaters and unit heaters. The Lee system gives heat WHEN needed and WHERE needed. It begins to distribute heat immediately after fire is lighted and fan started, responds promptly without lag. Air-flow is counter-current to flow of combustion gases, so that air becomes warmer as it extracts heat from the progressively hotter gases. Lower installation cost than steam or hot water; requires no licensed attendant; provides ventilation without additional cost. No expensive installation or maintenance of pipes, traps, valves, and pumps. Used with oil or gas, also with coal (stoker or hand-fired). Four main types illustrated here—send for Bulletin 10 with complete facts.

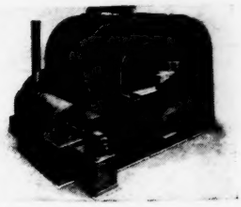
BRICK-SET TUBULAR HEATER

For use with central heating system (with duct distribution). Single heater capacities, 2,800,000 to 8,000,000 Btu per hour. Battery of two operating as unit, provide over 10,000,000 Btu per hour.

Brick Set Tubular Heater

STEEL ENCASED TUBULAR HEATER

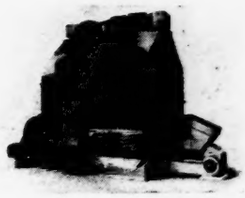
For use with central heating system (with duct distribution). Capacity range. 2,000,000 to 6,000,000 Btu per hour. May be installed in heated area without enclosure, requires no foundation. Unit may be moved by taking apart and reassembling.



Steel Encased Tubular Heater

TUBULAR UNIT HEATER

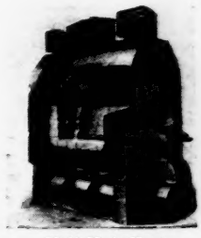
For use as central system (with duct distribution) or as unit heater, with adjustable outlet nozzles. Capacity range, 2,000,000 to 6,000,000 Btu per hour. In sizes up to 4,000 000 Btu, shipped completely assembled with all but mechanical equipment, refractory lining and controls in place. Requires no foundation. Equipped with crane hooks for moving.



Tubular Unit Heater

SHELL UNIT HEATER

For use with or without distributing duct system. Capacity range. 300,000 to 2,000,000 Btu per hour. Both hand and stoker-fired models. All units shipped completely assembled, wired, ready for operation. Units furnished with either refractory lined or stainless steel combustion chambers. Heaters may be floor mounted or suspended in any position.



Shell Unit Heater

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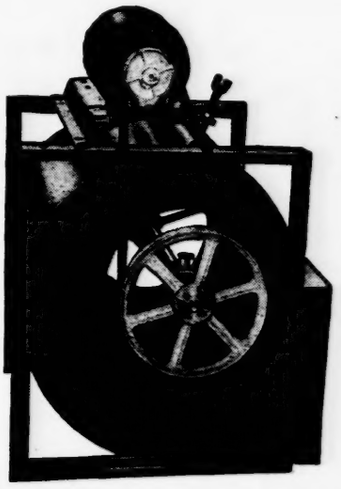
Built so they can be installed practically flush with the ceiling. AIR-FLO Ceiling Shutters present a refined, finished appearance. Their natural aluminum color blends with any decoration, eliminating need for painting, and no grille or winter cover is required. Furnished in 5 different widths, single panel up to 73" long. No operating mechanism shows. Built-in fusible link. Meets fire underwriters requirements.

WRITE FOR NEW CATALOG 43-F

Illustrations and details of the complete AIR-FLO line.

AIR CONDITIONING PRODUCTS CO.

2340 W. LAFAYETTE BLVD. • DETROIT 16, MICH.



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NEW

UNIVERSAL TYPE "N" BLOWER

MASSACHUSETTS . .

By changing the position of the oil cup, the four popular discharges (lower horizontal, upper horizontal, down-blast and up-blast) can be obtained. Sizes 7 to 16½ inches wheel diameter.

WRITE FOR BULLETIN No. 110 CATALOG

MASSACHUSETTS BLOWER DIVISION

The BISHOP & BABCOCK Mfg. Co.

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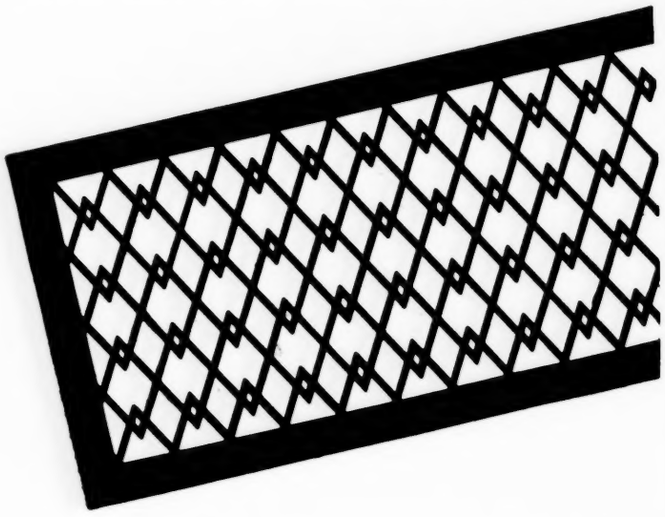
Hendrick Bulator

the dual-unit combination of a deflecting vane grille and an ornamental grille



Now you can secure in a single installation all the advantages of an adjustable vane grille—*to direct air flow*—and an ornamental grille — *to harmonize with the decorative scheme* — by specifying the new dual-unit Hendrick BULATOR. It is the first practicable combination that meets both the engineer's specifications for air throw and spread, and the decorative requirements of the architect.

In this dual-unit, the deflecting vanes are not noticeable, although they are mounted just behind the ornamental grille. The vanes are adjustable so that the air flow can be deflected to right or left, up or down, or in a combination of directions.

For the imposed ornamental grille section of the dual-unit Bulator, Hendrick offers a wide selection of attractive designs, with the open area essential.

Write for detailed information on the BULATOR.

See our catalog in SWEET'S

Perforated Metals
Perforated Metal Screens
Architectural Grilles
Mitco Open Steel Flooring,
"Shur-Site" Treads and
Armorgrids

HENDRICK
Manufacturing Company
42 DUNDAFF STREET, CARBONDALE, PA.
Sales Offices in Principal Cities

Aluminum Shade Screening

In a 16-page data book on Kaiser aluminum shade screening, charts illustrate how the screening blocks solar radiation under maximum heat conditions. Included are engineering data based on transmission temperature tests on shade screening compared with ordinary insect screen. Tables enable calculation of cooling loads.—*Permanente Products Co., Kaiser Building, Oakland 12, Calif.*

Item 180

Pumps

A new catalog describing the complete Everite line of pumps contains illustrations of all models as well as cutaway views, performance tables, engineering data and other information. Details are included on Everite shallow well pumps (vertical, horizontal, engine driven), deep well systems (reciprocating and jets), cellar drainers and sump pumps.—*The Everite Pump and Manufacturing Co., 614 N. Prince St., Lancaster, Pa.*

Item 181

Combustion Safeguard

Bulletin, No. W1816, describes a new combustion safeguard, known as the Bristol Electronic Pyrotrol, for protecting gas-fired ovens, furnaces, kilns, boilers, dryers, kettles, and similar industrial heating equipment from the danger of gas explosions during ignition, operation, and shut-off.—*The Bristol Co., Waterbury 91, Conn.*

Item 182

Refrigeration Equipment

Two new refrigeration equipment catalogs are: Catalog BJ-848 providing engineering data on the B & G Hydro-Flo direct expansion evaporator line, including a section on simplified selection procedure and diagrams of typical refrigeration and cooling systems; and Catalog CD-649 featuring B & G finned tube condensers in both straight tube and "U" bend models, with methods of correct selection, capacities, dimensions and other engineering data.—*Bell and Gossett Co., Morton Grove, Ill.*

Item 183

Centrifugal Pump Handbook

The how and why of centrifugal pump construction and maintenance are set forth in a 16-page bulletin, with tables of friction loss, causes and cures of troubles, maintenance schedules, etc.—*Allis-Chalmers Manufacturing Co., 1172 S. 70th St., Milwaukee, Wis.*

Item 184

Intake Filters

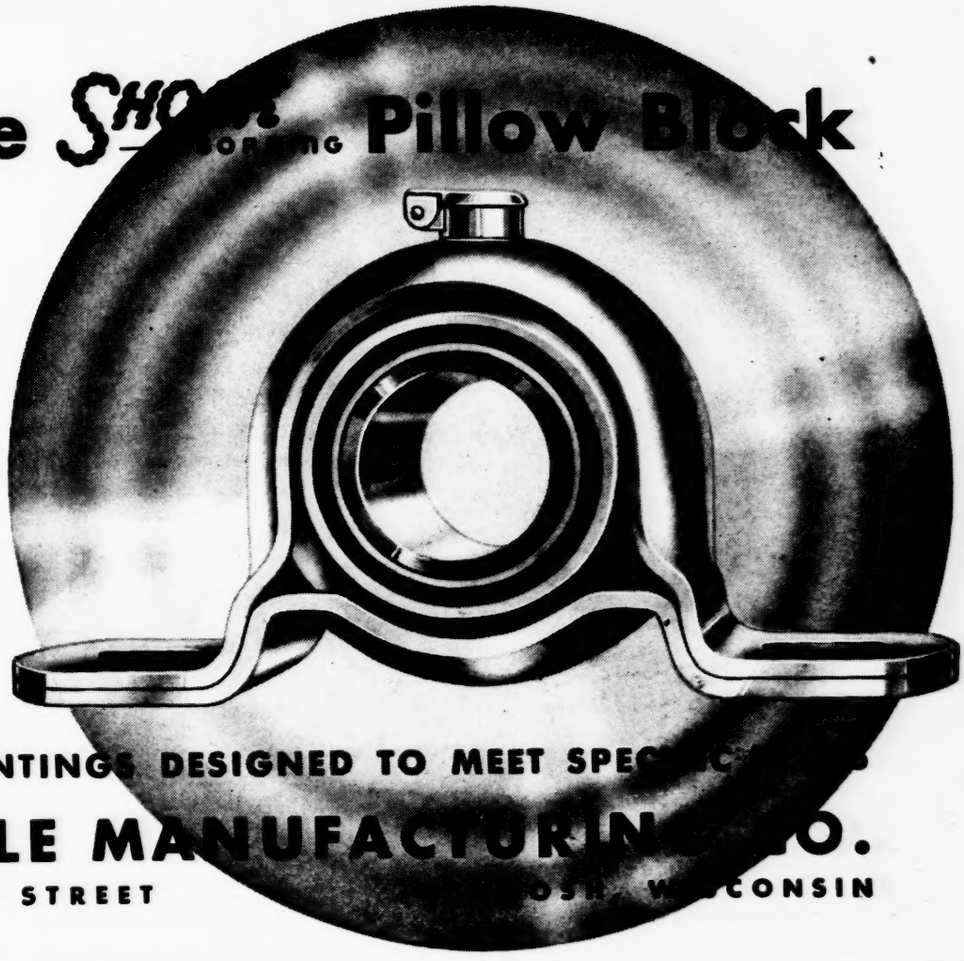
Staynew dry type intake filters in various models for intake air for compressors, motors, etc., are described and illustrated in a 4-page folder.—*Dollinger Corp., 56 Centre Park, Rochester 3, N. Y.*

Item 185

Triangle Sh[illegible] Pillow Block

- PROVEN DESIGN
- BUILT-IN CUSHIONS
- NEW LOW PRICES

Send for Details Today

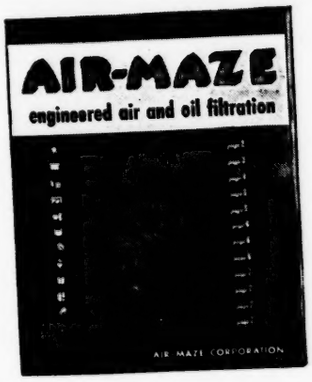


SPECIAL MOUNTINGS DESIGNED TO MEET SPEC[illegible]

TRIANGLE MANUFACTURING CO.

396 DIVISION STREET [illegible], WISCONSIN

JUST OUT! Your guide to better air and oil filtration! FREE!



This new Air-Maze catalogue gives you information you should have about the latest developments in air and liquid filtration. Whether you build or use engines, compressors, air conditioning and ventilating equipment, or any device using air or liquids, you'll want to have this handy guide at your finger tips. Send for your free copy today!

INCLUDES PICTURES AND INFORMATION OF THE FOLLOWING AIR-MAZE PRODUCTS:

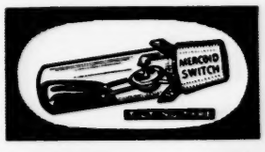
- Air filter panels and water eliminators
- Oil bath air filters
- Electromaze electric air filter
- Unimaze and Multimaze oil wetted air filters
- Air intake silencers and filter silencers
- Back fire flame arresters and tank vent arresters
- Breather filters
- Oil and fuel filters
- Oil separators, screen type
- Oil separators, electrostatic type
- Exhaust spark arresters
- Pipeline filters

AIR-MAZE CORPORATION, CLEVELAND 5, OHIO

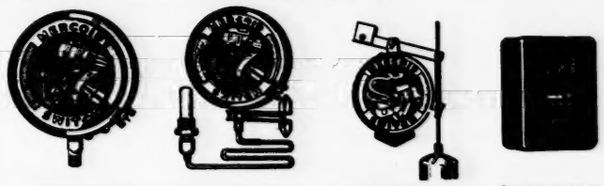
MERCOID

AUTOMATIC CONTROLS FOR HEATING, AIR CONDITIONING, REFRIGERATION AND VARIOUS INDUSTRIAL APPLICATIONS

THE ONLY 100% MERCURY SWITCH EQUIPPED CONTROLS



The distinguishing feature of Mercoid Controls is the exclusive use of Mercoid hermetically sealed mercury switches. These switches are not subject to dust, dirt or corrosion, thereby assuring better performance and longer control life. The items shown below are but a few miscellaneous items. See Catalog No. 700 for the complete line.



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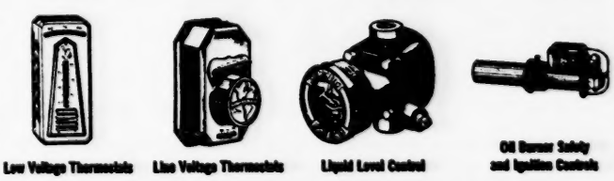

Low Voltage Thermostats | Line Voltage Thermostats | Liquid Level Control | Oil Burner Safety and Ignition Controls

If you have a problem involving the automatic control of pressure, temperature, liquid level, mechanical operations, etc., it will pay you to consult Mercoid's engineering staff — always at your service.

Manufacturers of Dependable Automatic Controls for Over A Quarter of A Century

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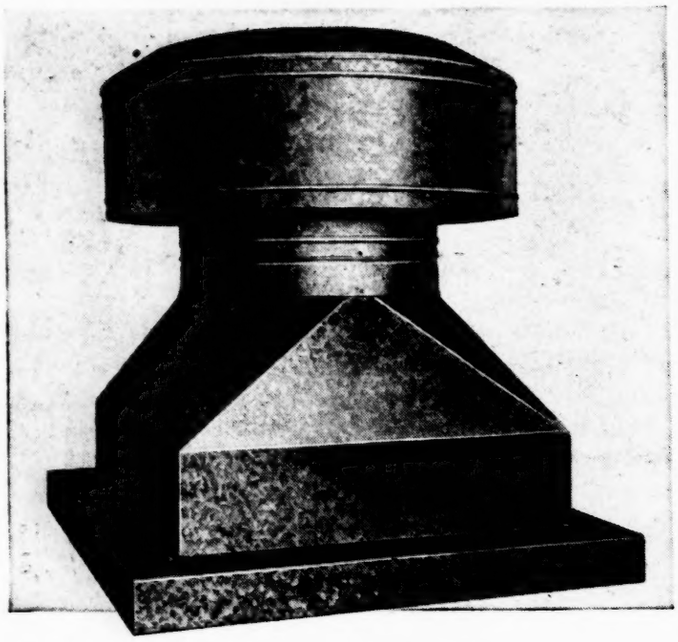


New moderate priced ventilator fills many needs

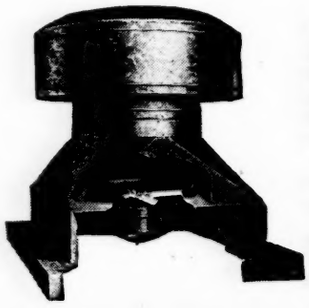
Swartwout

VALVENT

ROOF VENTILATOR

Gravity Model • Powered Model

In hundreds of places—for small buildings or miscellaneous hot spots—industrial and commercial, the new VALVENT fills a need for a simple, economical roof ventilator. It's the latest addition to Swartwout's line of high quality equipment. Sturdy galvanized steel construction; pleasing appearance; efficient air-flow design; unique double cone damper and air stream guide. Powered models have unusually effective propeller fan unit. Both models (gravity and powered) are made in 5 throat diameters —12, 18, 24, 30 and 36 in.



Capacities 650 cfm to 25,700 cfm. Simple damper chain lock permits any opening from full open to completely closed. Bases available to fit any type of roof.

Learn about Swartwout's new VALVENT Roof Ventilators . . . write for Bulletin 337.

THE SWARTWOUT CO.
18571 Euclid Ave., Cleveland 12, O.

Swartwout *Controlled* Air Circulation

Valve Comparison Chart

One of a series of engineering capacity comparison charts for guidance in selection of stainless steel 2-inch gate valves is included in a 4-page folder. Sectional drawings of competitive valves illustrate various points of comparison. — *The Cooper Alloy Foundry Co., Hillside, N. J.*

Item 186

Oil Burners

Low pressure air atomizing oil burners for manual operation and individual oil and air control that burn any grade of fuel oil are described and illustrated with cutaway drawings and charts of air flow ratios, dimension and capacity tables.—*Hauck Manufacturing Co., 124-136 Tenth St., Brooklyn 15, N. Y.*

Item 187

Unit Heaters

A 4-page bulletin, No. 248, describes Design 8 unit heaters. Heaters are suspension type with copper fin tubes and cast iron headers tested at 450 lb hydrostatic pressure. Steam capacity and heater selection charts are included.—*Chicago Fan and Fin Coil Co., 1937 W. Walnut St., Chicago 12, Ill.*

Item 188

Instruments

Catalog No. 15, 40 pages, 2 colors, describes and illustrates H-B thermometers, psychrometers, barometers, and hydrometers for plant and laboratory use. Special use thermometers in both high and low ranges, thermo regulators, and relays are included.—*H-B Instrument Co., 2633 Trenton Ave., Philadelphia 25, Pa.*

Item 189

Panel Heating Control

Technical Bulletin No. 2 covers centralized panel program with systems for hot water and radiant heating. Schematic diagrams of boiler hook-ups and wiring diagrams are included, illustrating control systems for large buildings.—*Sarcotherm Controls, Inc., Empire State Bldg., New York 1, N. Y.*

Item 190

Home Furnaces

An extended line of home heating equipment consisting of 30 different sizes and models of oil, gas and coal furnaces is introduced in an 8-page catalog. —*American Furnace and Foundry Co., Milan, Mich.*

Item 191

Diaphragm Control Valves

Series 700 diaphragm control valves are described and illustrated in a 31-page catalog showing mechanical and flow characteristics of air operated diaphragm motor controlled valves, with application data, dimension tables, ratings, etc.—*Minneapolis-Honeywell Regulator Co., Belfield Valve Div., Philadelphia 44, Pa.*

Item 192

Simplified Radiant Heating Design

A procedure for radiant panel heating design simplified for use by the average plumbing and heating contractor is set forth in a 28-page booklet entitled "Simplified Design Procedure for Residential Panel Heating." Procedure is based on basic data covering five characteristics of the heated space. Tables permit design without equations, graphs or other engineering. —*Revere Copper and Brass Incorporated, 230 Park Ave., New York 17, N. Y.*

Item 193

Registers and Grilles

Honeywell air diffusion registers and grilles are described and illustrated in a 12-page, 2-color catalog, with construction drawings, selection charts, and air balancing data. — *Minneapolis-Honeywell Regulator Co., Minneapolis 8, Minn.*

Item 194

Refrigeration Controls

A 12-page, 2-color catalog describes and illustrates White-Rodgers automatic controls for refrigeration and air conditioning. Line includes thermostats, relays, pressure and hydraulic controls, defrost controls, etc. Application and performance data are included.—*White-Rodgers Electric Co., St. Louis 6, Mo.*

Item 195

Air and Liquid Filtration

An 8-page, 2-color catalog describes and illustrates with photographs and cutaway drawings air filter panels, oil bath air filters, Electromaze electric air filters, silencers, flame arresters, breathers, and separators.—*Air-Maze Corp., 5200 Harvard Ave., Cleveland 5, Ohio.*

Item 196

U. S. Uniclosed Motor

An 8-page bulletin, No. 1524, in full color describes the U. S. Uniclosed motor with photographs and colored drawings. Features include asbestos protected windings, drip-proof housing, special lubrication, cyclone ventilation. Motors range from ¼ to 250 hp.—*U. S. Electrical Motors, Inc., 200 E. Slauson Avenue, Los Angeles 54, Calif.*

Item 197

Air Circulators

Emerson pedestal mounted, suspended and bracket mounted air circulators in 24- and 30-inch models are described in an 8-page bulletin, No. X6258. Suggestions on selection and installation are included.—*The Emerson Electric Manufacturing Co., St. Louis 21, Mo.*

Item 198

Enclosed Safety Switches

A 4-page bulletin describes Type A heavy duty industrial safety switches and gives application information. — *The Trumbull Electric Manufacturing Co., Plainville, Conn.*

Item 199

GREAT NORTHERN RAILWAY INSULATES UNDERGROUND PIPES WITH Z-CRETE*

modern system provides insulation that is

another "Z"crete success story

Four separate installations by Great Northern Railway are in themselves an endorsement of Z-crete's efficiency, economy, and ease of application.

Extra Efficiency and Protection

Z-crete Underground Pipe Insulation keeps heat *in the system,* as no other method does. No joints or cracks to leak heat, complete moisture-free protection.

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Furnished and installed by competent applicators, Z-crete is less costly to install—it's permanent and there's no maintenance. Won't get out of line, deteriorate, crack or crumble. Easily removed to repair pipes—ideal for reinsulating existing conduits. Send coupon below for complete information.

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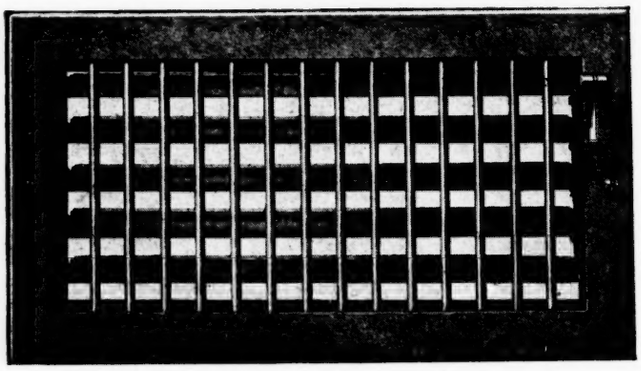
Multiple Deflection

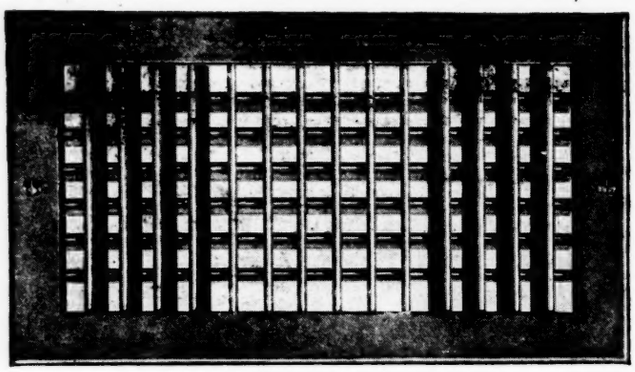
Air Conditioning

REGISTERS and GRILLES

— for high velocity outlets



1005V-HML. Single bank of bars, multi-louvre valve.



1205VH. Double bank of bars, no valve.

Streamliner registers and grilles for air conditioning systems provide **better** diffusion for high velocity outlets. The Series includes models with single bank of adjustable bars (vertical or horizontal), also with double bank of adjustable bars (vertical in front and horizontal in back, or the reverse), also all above four types with horizontal multi-louvre valves in the rear, controlled by lever on face of register.

Design of bars and method of mounting them are **original** with Auer. Bars are hollow moulded, beveled, perfectly formed, smooth in contour, and pivoted in the frame on special split sleeves. This expansion insert furnishes correct tension to hold bars firmly where set, yet allows sufficient free movement for adjustment with one simple tool. Bars may be set at any angle, in any grouping. Blades of multi-louvre valve are pivoted on rivets to prevent vibration. Streamliner registers are equipped with gaskets. You will be pleased with the beauty and fine craftsmanship of these registers. Write for folder S-49.

Complete Auer Register Book—or Catalog "G" on perforated grilles—sent on request.

THE AUER REGISTER CO., 3608 Payne Avenue, CLEVELAND 14, OHIO

Auer REGISTERS & GRILLES for AIR CONDITIONING & GRAVITY

Refrigeration Valves and Strainers

Catalog No. 200-3, 8 pages, 4 colors, describes and illustrates thermal expansion valves, magnetic valves, and refrigeration strainers. Drawings and tables guide equipment selection. Price list is included.—*General Controls, 801 Allen Avenue, Glendale 1, Calif.*

Item 200

Pipe Insulation

A new folder describes Kaylo pipe insulation with specifying and application data. Insulation is effective through the temperature range from 200F to 1200F.—*Kaylo Division, Owens-Illinois Glass Co., Box 1035, Toledo 1, Ohio.*

Item 201

Variable Speed Drive

A 12-page bulletin describes an alternating current motor having infinitely adjustable speed with a constant torque characteristic brought about by a new eddy current principle. The Ajusto-Spede operates directly from a 2 or 3 phase a.c. line. Models are available in ¾ hp to 75 hp units.—*The Louis Allis Co., Milwaukee 7, Wis.*

Item 202

Expansion Joint Guide

A design guide for expansion joint application and selection contains data covering corrugated type expansion joints, including formulas for calculating required anchor strength and a table of data on combined axial and lateral motion.—*Chicago Metal Hose Corp., Maywood, Ill.*

Item 203

Indicating Control Valves

Hi-Lift V-Port indicating type hand control valves are described with details of construction, general features, applications and dimension charts in a 20-page bulletin No. 242-1. Sizing charts and capacity nomograms are included for liquids, air, gases and steam.—*Minneapolis-Honeywell Regulator Co., Belfield Valve Div., Philadelphia 44, Pa.*

Item 204

SEPTEMBER, 1949

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Editor, HEATING AND VENTILATING
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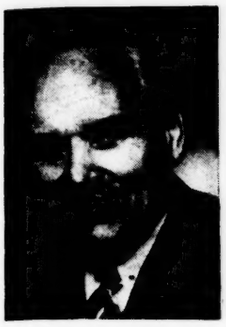

J. C. H. Wendes

J. C. H. Wendes *(Refrigeration Requirements in the Manufacture of Cold Rubber*, page 57) operations manager, synthetic rubber division, United States Rubber Company, has played a prominent role in the design of synthetic rubber plants and other chemical production equipment over a period of more than 20 years. Born and educated in Sweden, Mr. Wendes was graduated as an engineer in 1912.

He joined the rubber company in 1928 as design engineer at its chemical plant in Naugatuck, Conn. In 1932 he was promoted to plant engineer and supervised the design of many special units for production of rubber chemicals and other products of the division. He was called upon to design the company's synthetic rubber plant in Naugatuck, one of the first plants in what was to become an important war industry. Many of his design features were later incorporated in the vast Government synthetic rubber standard plant program. During World War II, Mr. Wendes also served as engineering superintendent at the TNT plant operated by the company at Williamsport, Pa.

In 1943 he was appointed consulting engineer for the Naugatuck chemical and synthetic rubber division with headquarters in New York and in 1945 became chief engineer for those divisions. In 1948 he became operations manager of the synthetic rubber division.

E. Sternberg

Edwin Sternberg *(Navy Installs Air Conditioned Television Studio*, page 61) is a consulting engineer in charge of air conditioning and ventilation with Fred L. Moesel Associates, Consulting Mechanical Engineers in New York City. He was born in New York City and received his engineering degree from Cornell University.

Following his graduation he was employed as a test engineer with a large utility company. He later went into factory planning and engineering work where he had to deal with air conditioning and refrigeration problems. This work so interested him that he decided to specialize in this field. Since then his experience has included a large variety of air conditioning projects in the commercial and industrial fields. During the war he supervised the engineering design and later the installation of air conditioning aboard a new class of fully air conditioned naval vessels.

H. H. Daisley

Herbert H. Daisley *(Flat Patterns for Round Elbows*, page 66) started with Ray, Daisley & Co. in 1911 at their original establishment, 61 Fulton Street, Brooklyn, N. Y., where his great grandfather, John Ray, started the business in 1855. During his apprenticeship years he attended vocational night school classes in the Brooklyn Evening High Schools, and in 1916 was granted a license to teach in New York City's Pre-Vocational School System.

After one year of teaching he entered the shipyard field as ship fitter. This work was interrupted by service in the army as sergeant in the

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Kritzer Coils with deep collar fins and chamfered or sharp threaded pipe means an *engineered* coil from the standpoint of both heating efficiency and fast installation.

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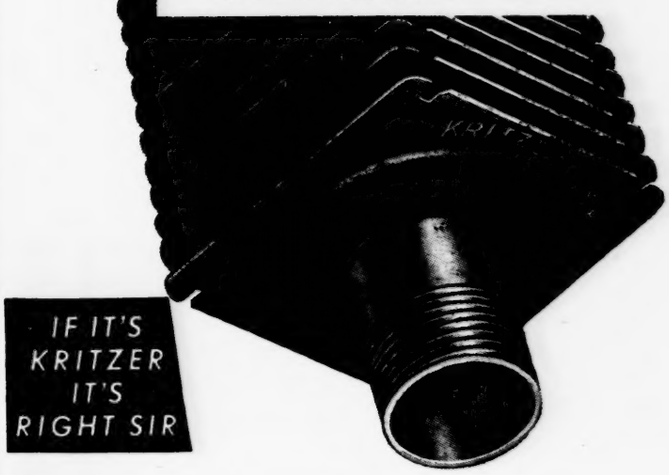

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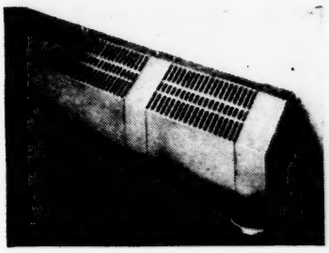

The new Kritzer solid front Commercial Baseboard Grille is a clean, attractive grille made with solid end pieces and joint covers. Ideal in schools, offices and public rooms. Where this type of heating installation is desired the Kritzer Radiant Baseboard Grille is a fine solution.

KRITZER COMMERCIAL "FIN-PIPE" COILS

Steel Pipe 2″ pipe size .035 Steel Fins Heating Surface 6 sq. ft. per lineal foot	Steel Pipe 1¼″ pipe size .035 Steel Fins Heating Surface 5¼ sq. ft. per lineal foot	1¼″ copper Tube (1⅜″ OD) .020 Copper Fins Heating Surface 4¼ sq. ft. per lineal foot

KRITZER RADIANT COILS, INC.

2907 W. Lawrence Ave., Chicago 25, Ill.

Gentlemen: I'm interested. Please send complete information and bulletin on Kritzer Commercial "Fin-Pipe" Coils.

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ALLEN TURBINE VENTILATOR

The pioneer of turbine ventilators, originated by Allen, and now in use in thousands of installations in industry and commerce.

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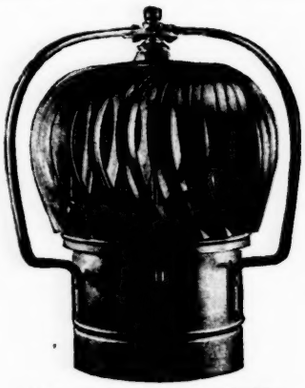

Allen Type "C" Turbine Ventilator shown. Allen's famous "Coni-Vane" and Type "A" Armless Turbine Ventilators are also available.

For economical but positive and thorough ventilation, these ventilators will give maximum performance per dollar spent! Ventilator operates on wind power, on sensitive but rugged bearings. Rotors are built up of die-formed blades, in perfect balance and uniformity. Easily lubricated Oilite and hardened alloy steel bearings assure long life. Made of prime sheets of heavy-gauge galvanized iron, spot welded for permanence. Throat diameter, 6 to 48 in. Free air displacement (based on 10 ft. stack height, 20F temp. diff.), 5740 to 267,800 cu. ft. per hr. Write for catalog on complete line of roof ventilators.

Representatives in most principal cities

ALLEN VENTILATOR DIVISION
PRODUCTION PLANNING COMPANY
Rochester, Michigan

HERE'S YOUR COVER FINISH

No need to sew covers onto insulation. Cementing saves time, costs less. Arabol Lagging Adhesive — developed for war needs — now meets all requirements on installations of all sizes. Easily applied, dries quickly, requires no painting. Write for Bulletin #14.

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110 East 42nd St., New York 17, N. Y.
1835 S. 54th Ave., Chicago 50, Ill.
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Asbestos?... ARABOL!

SHALLO-WELL
OIL-FIRED FLOOR FURNACES
Only 34 inches high
BTU CAPACITIES OF
★ 50,000 ★ 60,000
★ 70,000
Write for Details!

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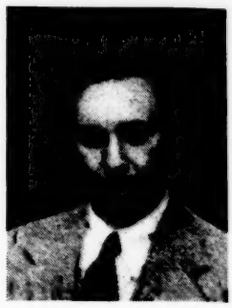
2226 S. THIRD STREET
COLUMBUS 7, OHIO

Underwriter's Approved

Infantry Training Cadre. He then returned to Ray, Daisley & Co. and within a year was in complete charge of the plant.

During World War II, Mr. Daisley again was granted a teacher's license and served the National Defense Program in Brooklyn and Queens vocational schools.

In 1933, Ray, Daisley & Co., moved to new quarters at Lindenhurst, L. I. In 1942 this plant and its facilities were turned over to the Grumman Aircraft Engineering Corp., Bethpage, L. I., and Mr. Daisley joined their Tool Engineering Department. Ray, Daisley & Co. repossessed their premises and tools in 1946.



F. Kramrisch

Fritz Kramrisch (*An Improved Method for Supporting Horizontal Storage Tanks*, page 63) has been with Albert Kahn Associated Architects and Engineers since 1940 as a structural engineer. Prior to this association he was employed by several construction firms in England and Austria. In 1933 Mr. Kramrisch was graduated as Civil Engineer from the Technical University of Vienna; two years later he became a Doctor of Engineering. At present he is teaching a course in Structural Design at the Lawrence Institute of Technology, Detroit. Mr. Kramrisch is a member of the American Society of Civil Engineers. He has prepared a number of technical papers which have appeared in various publications in this country and abroad.

Maria Telkes (*A Review of Solar House Heating*, page 67) is a member of the department of metallurgy, Massachusetts Institute of Technology. Since the publication of her article, "Solar House Heating, a Problem of Heat Storage" and biography (H & V, May, 1947) she has gained considerable notoriety through her widely publicized design of a solar heated house that was erected at Dover, Mass., through private funds.

. . . Since the Last Issue

The promotion of two veteran employees to important executive positions has been announced by **Johnson Service Co.**, Milwaukee, manufacturers of and contractors for automatic temperature control systems. **Paul D. Gayman**, manager of the Cleveland branch since 1938, has been appointed manager of the company's western district with headquarters at Milwaukee. Succeeding him in Cleve'and is **Parker D. Shepperd**, formerly senior sales engineer in Detroit.

L. J. Wing Mfg. Co., manufacturers of heating, ventilating and combustion equipment, announce the appointment of **Albert D. Becker** as representative for the eastern section of New York State, Vermont and Berkshire County in the State of Massachusetts. Mr. Becker will maintain his headquarters at 434 Clinton Avenue, Albany, N. Y. Also announced is the appointment of **Fred McMeans**, as representative for the Province of British Columbia, Canada. Mr. McMeans will maintain his headquarters at 451 West Broadway, Vancouver, B. C.

The **Wagner Electric Corp.** of St. Louis, Mo., announces the appointment of **R. E. Bryant** as manager of the Automotive and Electrical Branch at Buffalo, New York.

Appointment of **W. E. Conkright** as sales promotion and advertising manager of **General Controls Co.**, Glendale, California, has been announced. Mr. Conkright's former connections include the International Harvester Co. and the Harnischfeger Corp. of Milwaukee, Wis.

Appointment of **U. L. Plain** as assistant sales manager for the **Insulite Division of Minnesota and Ontario Paper Co.**, Minneapolis, has been announced. Mr. Plain joined Insulite in 1928 as assistant export manager. Prior to his present promotion he was assistant to the vice president in charge of sales for all operating divisions, a position he had held since 1946.

Photoswitch, Inc., announces the appointment of **Oscar C. Stark** as general sales manager, with headquarters in the factory sales office, 39 Broadway, New York City.

General Controls Co., Glendale, Calif., has announced the opening of a new factory branch office in Cincinnati, Ohio, to service southern Ohio, southeastern Indiana and central Kentucky. This new office, located at 307 E. 4th Street in Cincinnati, will be headed by **Jack Prutow**, branch manager. General Controls' Oklahoma city office has been moved to 1427 E. 6th Street in Tulsa.

President Theodore E. Seelye of the **Automatic Electric Heater Co.**, Pottstown, Pa., has announced that, effective July 26, the firm name was changed to **Sepco Corp.** in order to identify the company style more closely with the trade name of many of its products. No changes have been made in company ownership, management, or policies.

Perfex Corp., Milwaukee, manufacturer of automatic temperature controls and industrial engine radiators, has announced that **W. A. Matheson, Jr.**, has been named manager of their newly created New Products Division. Mr. Matheson recently was manager of contract sales for Williams Oil-O-Matic Division of Eureka Williams Corporation.

American Structural Products Co., recently reorganized subsidiary of **Owens-Illinois Glass Co.**, has announced the election of the following new officers: **C. R. Megowen**, chairman of the board; **S. J. McGiveran**, president; **E. B. Dennis, Jr.**, **K. M. Henry** and **S. A. Kenworthy**, vice presidents; **J. H. McNerney**, secretary-treasurer; **J. S. Rinehart**, comptroller, assistant secretary and assistant treasurer; **E. F. Martin**, assistant secretary and assistant treasurer; **J. A. Serra**, assistant secretary; and **A. H. Ahlers**, assistant treasurer. Directors are: **J. P. Levis**, **W. E. Levis**, Mr. Dennis, Mr. Henry, Mr. Kenworthy, Mr. McGiveran, Mr Megowen and Mr. Rinehart.

E. G. Peterson

Peabody Engineering Corp., New York, N. Y., manufacturers of fuel combustion equipment, gas scrubbers, gas coolers and direct fired air heaters announces the appointment of **Eric G. Peterson** as general manager. Mr. Peterson will continue as general sales manager of a'l products in all divisions. A graduate of Stevens Institute of Technology, Mr. Peterson served as an engineer officer in the U. S. Navy during World War I. After several years in power plant work in South America, he became associated with Peabody Engineering Corp. in 1928 in the capacity of engineer, later transferring to the sales department.

The **C. A. Dunham Company** announces the following July changes in its sales organization: In Chicago, sales engineer **W. C. Zingheim** retires. The Chicago sales and service office will be under the management of **George A. Mansinger.** In Detroit, sales engineer **W. H. Baldwin** retires and is succeeded by **C. C. Grubb**, formerly at Akron, Ohio. In Louisville, after 37 years as sales engineer, **Wallace Hoeing** retires. He is succeeded by **David J. Rank**, formerly located at Indianapolis. In Akron, Ohio, **William W. Evans** succeeds Clair Grubb (removed to Detroit) as sales engineer. In Columbia, S. C., sales engineer **R. K. Rouse** of Greenville, S. C., has established another office at Columbia with **W. M. Plowden** as local manager.

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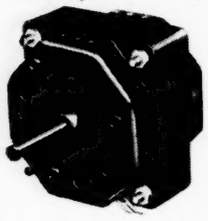

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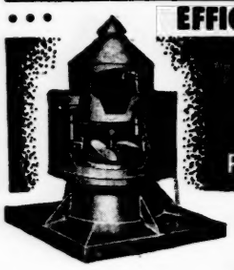

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Wholesalers' salesmen from New England, New York, Ohio, Michigan and Illinois, attended a class from July 25 through July 28 at the **C. A. Dunham Co.** plant in Michigan City, Indiana. The four-day program was under the chairmanship of assistant sales manager **Walt S. Browning**, assisted by the heads of the convector, unit heater, pump and specialty divisions.

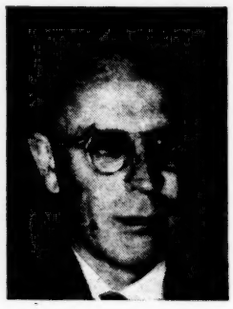
Formation of **Mechanical Industries, Inc.**, a new engineering company whose activities will be limited to industrial ventilation, smoke, dust and fume control, with headquarters in the Frick Bldg., Pittsburgh, has been announced by **Morton I. Dorfan**, president and general manager. Prior to establishing the firm which he will head, Mr. Dorfan supervised dust control sales, engineering and research activities for the American Wheelabrator & Equipment Corp.

Dr. Amos Turk, formerly of the chemistry department, City College of New York, has been appointed director of research and development of the **W. B. Connor Engineering Corp.**, manufacturers of activated carbon air purification equipment.

William M. Hankins, special sales representative of the **Kuhlman Builders Supply & Brick Co.**, joined **Owens-Illinois Glass Co.** August 1 as general sales manager of the company's Kaylo Division. Mr. Hankins has been associated with Kuhlman since 1938. He was educated at Georgia Military Academy and the University of Alabama, where he studied engineering and business administration.

Hugo T. Wilder has been made manager of the marketing division of **Aluminum Company of America's** sales department. Mr. Wilder has been with ALCOA since 1919.

Motor Wheel Corp. has announced the appointment of **Karl Egeler** to the position of sales manager, Duo-Therm Division. **Louis C. Vandertill** has been appointed as advertising manager, Mr. Egeler's previous post. Mr. Egeler joined Duo-Therm in 1932 as advertising manager. In 1940



K. Egeler

L. C. Vandertill

he was given additional duties as sales promotion manager. Mr. Vandertill has been with Duo-Therm since September of 1948 as assistant advertising manager. Prior to that time he was connected with Beurmann-Marshall, Inc., and the Blakslee Advertising Agency, both of Lansing, Michigan.

The Youngstown Sheet and Tube Co. is establishing a department of public relations, which is a new division. The department will be in charge of **Stuart D. Goulding** as director of public relations. His office will be located in the Stambaugh Building, Youngstown, Ohio. Mr. Goulding was born in Providence, Rhode Island. He is a graduate of Brown University and was associated with the Rheem Manufacturing Co., New York, as public relations manager.

Election of **A. F. Westerfield** as vice president of **United States Radiator Corp.** has been announced. Mr. Westerfield, during the past 23 years, has been manager of the corporation's southern branch.

R. A. Bissell

The promotion of **R. A. Bissell** to sales promotion manager of **Bryant Heater Division, Affiliated Gas Equipment, Inc.**, has been announced. Mr. Bissell spent thirteen years with Brooklyn Union Gas Co. as district heating supervisor before he joined Bryant's New York factory branch in 1945. He has been with the Cleveland headquarters' office since December, 1948. He will co-ordinate Bryant sales promotion activities for the entire United States.

Fred H. Gallup has been appointed manager of distributor sales of the automatic heating division of the **General Electric Co.'s** Air Conditioning Department.

John A. Robinson has been named regional sales manager for the midwest, northwest, Rocky Mountain and Pacific Coast areas for **Brown Instruments Division, Minneapolis-Honeywell Regulator Co.** Mr. Robinson started with the Brown company 20 years ago at the Philadelphia main plant. He will make his headquarters in Chicago where he has been branch industrial manager. He is succeeded in that post by **Charles E. Sharp.**

At its August meeting the board of directors passed the following resolution: "Be it resolved that the board of directors of **C. A. Dunham Co.** extend to **A. R. Welker** grateful appreciation of his services in many positions, including that of incorporator and officer of several subsidiary companies, credit manager, and finally secretary and treasurer of the company, in the performance of all of which services he has distinguished himself and well served the interests of the company." Mr. Welker has retired after 39 years with the company.

COMING EVENTS

Where listed, names or titles of individuals are those from whom further information is available.

CORROSION MEETING—South central region meeting of the National Association of Corrosion Engineers, at Adolphus Hotel, Dallas, Tex. G. R. Olson, United Gas Pipe Line Co., Box 1407, Shreveport 92, La. .....**OCTOBER 3-4, 1949.**

PLUMBING AND HEATING MEETING—Annual meeting of the Plumbing and Heating Industries Bureau, at Palmer House, Chicago, Ill. Norman J. Radder, secretary of Bureau, 35 E. Wacker Dr., Chicago 1, Ill. .....**OCTOBER 5, 1949.**

AERONAUTIC MEETING—SAE national aeronautic meeting and aircraft engineering display, of the Society of Automotive Engineers, at Hotel Biltmore, Los Angeles, Calif. C. F. Thomas, general chairman, 29 West 39th St., New York 18, N. Y. .....**OCTOBER 5-8, 1949.**

WELDING AND METAL MEETING—30th annual meeting of the American Welding Society, in conjunction with the National Metal Congress, at Cleveland Hotel, Cleveland, Ohio. Secretary of Society, 33 W. 39th St., New York 18, N. Y. .....**OCTOBER 16-21, 1949.**

AGA CONVENTION—1949 annual convention, American Gas Association, at Chicago, Ill. For details, contact secretary, AGA, 420 Lexington Ave., New York 17, N. Y. .....**OCTOBER 17-20, 1949.**

METAL EXPOSITION—31st national metal exposition, in conjunction with the National Metal Congress, at Cleveland Public Auditorium, Cleveland, Ohio, sponsored by American Society for Metals. W. H. Eisenman, managing director, 7301 Euclid Ave., Cleveland 3, Ohio. .....**OCTOBER 17-21, 1949.**

(Continued on page 126)

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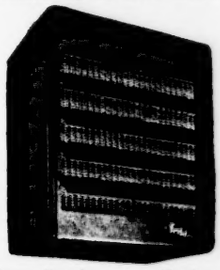

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